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AMAZING STORIES

May, 1930
Vol. 5, No. 2

Experimenter Publications, Inc.
B. A. Mackinnon, Pres. H. K. Fly, Vice Pres. and Treas.

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Our Cover

this month illustrates a scene from Part I of the story entitled, "The Universe Wreckers," by Edmond Hamilton, in which the four travelers, fitted out in their space-walker suits, are making the necessary repairs to their space-flier, which sustained some damages while going through the asteroid zone on their way to Neptune.

In Our Next Issue:

PIRACY PREFERRED, by John W. Campbell, Jr. In this story, as in his previous ones, our young author offers us a rare combination of accurate science with excellently written fiction—which makes a perfect AMAZING STORY. This time, Mr. Campbell looks into the future of aviation—a subject which at the present time compels a universal interest.

THE NON-GRAVITATIONAL VORTEX, by A. Hyatt Verrill. When we discover what gravitation is, scientists will perhaps find it less impossible to annihilate gravity. This is an extraordinary tale, dealing with vortices that develop a strange phenomenon—the local annihilation of gravitation.

ELEMENT No. 87, by Ralph Linn. Chemists have determined from various considerations that there can be only 92 original elements in the chemical scale. Only comparatively recently have a goodly number of these been discovered. But there still remain a few about which chemists know little or nothing, and there is no telling what possibilities an undiscovered element might hold. Our author uses this idea in an exceedingly clever bit of scientific fiction.

THE UNIVERSE WRECKERS, by Edmond Hamilton. (A Serial in 3 parts) Part II. In this instalment our four travelers experience many dangers with the extraordinary beings of Neptune, which is nearly 3 thousand million miles from the sun, but they learn the source of the power that has caused the increased rotation of the sun, which threatens the life of all the nearer planets in the solar system.

FLAMINGO, by Clarence Edward Heller. Much has been said in the daily journals of wonderful robots, the direct successors of the almost historical "steam man" of two generations ago. But think what would happen if not only the servant and the manual worker were replaced by robots—if even our great singers and famous actors were likewise replaced in such manner. Our new author has woven a charming extravaganza of the amusements of the future—not so very far in the future, at that.

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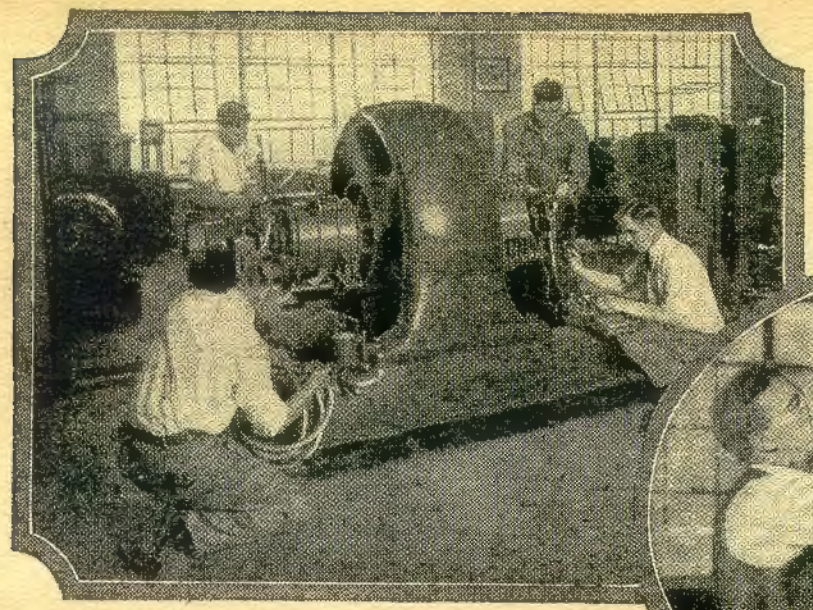

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VOLUME 5

AMAZING STORIES

THE MAGAZINE OF SCIENTIFICTION

MAY, 1930
No. 2

T. O'CONOR SLOANE, Ph.D., *Editor*
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Editorial and General Offices: 381 Fourth Avenue, New York, N. Y.

Extravagant Fiction Today - - - - - - - - - Cold Fact Tomorrow

Living on the Surface

By T. O'Conor Sloane, Ph. D.

FOR many years, travelers on the East River used to see a sort of a hulk, or barge, anchored permanently about half way to the mouth of Long Island Sound. The story was told that a British ship the "Hussar," carrying a quantity of gold coin, estimated to be about $4,000,000 in value, to pay the British soldiers in America, in Revolutionary times, had sunk in that locality, and the barge was supposed to be there to be used in recovering the gold. And this story, in a way, can be repeated of various localities on the ocean's floor. Ship after ship has been sunk, in numberless cases carrying treasure enough to make many men's fortunes if it could only be salvaged. Thus, if it were possible to get into the treasure-room of the *Lusitania*, it is understood there would be a very large sum of coin to be saved. Ship after ship carrying treasure has met this fate and has been sunk in more or less deep water.

Now we may go the other way. One of mankind's ambitions, often a sporting achievement, if we may use that expression, has been the climbing of mountains. One after another, of what we consider the gigantic eminences on the earth's surface, have been scaled by Alpine climbers until few of the very highest remain unconquered. In the Himalaya range, a height of over five miles above the sea level is reached by some of the peaks, and they have not all been climbed. And while it is not safe to make any such assertion, in view of what men accomplish, it is somewhat doubtful if Mount Everest will ever be ascended. Near one of the West India islands, one of the deepest spots of the ocean is to be found, going down to about the same distance that Mount Everest rises.

So mankind, living on the surface of the earth and moving about on it, has developed two desires—one to go up far above the surface of the earth; another to go down below the surface of the ocean. If we consider his greatest achievements in these two lines and determine their general proportional value to the size of the earth, it will be seen that man can do virtually nothing in the departure from the surface level of the earth. The greatest heights which have ever been attained have been in airplanes. As greater and greater heights are reached, the air becomes rarer, and oxygen cylinders or other containers have to be relied on to supply the necessary oxygen gas. The cold is very great, so that every one of these record-breaking attempts has involved the greatest hardship, danger to life, and is an example of the heroic, if we can only figure to ourselves that it does any good to humanity.

We may take the earth as being about eight thousand miles in diameter. It will be seen that the greatest altitude attained by man is six eight-thousandths of the diameter of the sphere on which we live. The impressiveness of magnitude, it may be said, lies in proportion; the six miles that we have taken as a rough approximation of the height reached by the aviator is less than one one-thousandth of the earth's diameter—about three-quarters of a thousandth. On a fair size globe, say one ten inches in diameter, this height would be represented by about one-hundredth of an inch, or a little less than that. To get an idea of what this is, you may take a book and you will find that a page, if of reasonably thick paper, is about one two-hundredths of an inch thick, so that a couple of pieces of paper pasted one on top of the other on the globe would represent the great achievement of the aviator and the approximate height of Mount Everest.

This certainly seems to be very little. But when it comes to going down into the earth instead, the best that man can do may figuratively be stated to be of microscopic extent. A good deep level for a diver to attain is one hundred and fifty feet as the practical view of the maximum which has ever been reached. Take it in proportion to the diameter of the earth, and it comes to something like the thirty-thousandth part of the diameter, so that on our ten-inch globe it would represent a depression of about the three-thousandth of an inch.

The question of the supply of oxygen for the lungs is one of the great problems in flying to great altitudes. But, in going down in the water, the diver has to be supplied with air at high pressure, so that he gets plenty of oxygen. About four-fifths of the air is nitrogen, an absolutely inocuous, harmless gas, but curiously enough, this is the gas which the diver has to think of; this is the gas which gives him the divers' disease known as the "bends." As nitrogen is somewhat soluble in water, and of course much more so at high pressure than at low, the effect is that the diver's blood under the high pressure dissolves a quantity of nitrogen, and if brought up rapidly out of pressure, this nitrogen, presumably assuming the gaseous form, fills the diver's veins with bubbles, and, perhaps it is fair to say, by its mechanical effect, gives the disease called the "bends." The caisson worker, or the deep-sea diver, is protected from this disease by a gradual release of the pressure. It has even been proposed to supply divers with a mixture of helium gas and oxygen. The helium gas is supposed to have no effect upon the system on account of its insolubility in water. Often, to cure the "bends," an iron cylinder, into which the sufferer is introduced, forms part of the outfit. In it the pressure is brought up to the original and then very slowly diminished. In this way the nitrogen escapes from the blood and the disease succumbs to the effect of the "iron doctor," as the cylinder is termed. Lack of oxygen, one of the constituents of the atmosphere, prevents ascending; excess of nitrogen, the other principal constituent, causes trouble in deep-sea diving.

And now it is said that Captain Simon Lake, the pioneer inventor of the submarine, wishes to attempt the recovery of the famous "Hussar."

Many of our stories bring in the fourth dimension and man glories in living in a three dimensional world. But when we think that he cannot go up or down to any but the most trivial proportional amount, that if he can get a drill more than a mile down into the ground it represents an achievement, we may feel justified in calling man little more than a two dimensional being.

The Universe

A Serial in Three Parts—Part I

By Edmond Hamilton

Author of "Locked Worlds," "The Other Side of the Moon," etc.

IT is problematical whether the enormous distance that lies between the earth and Neptune is the only reason why so much on that planet remains a mystery to astronomers. If the great sphere were not so remote, much might be revealed to us. What might have happened to some of the other planets, perhaps so much older than the earth, and what might be found upon them, might easily exceed the pale of human conception. But that is exactly why the subject of the possibilities of life 2000 millions of miles away from us, opens such a fertile field for writers of scientific fiction. And there is no assurance that the sun, for instance, should continue indefinitely to turn at its present speed. What might happen if it should, for some reason, begin rotating at an increasing frequency? Mr. Hamilton, who needs no introduction to readers of AMAZING STORIES *and certainly needs no further commendatory note, concerns himself chiefly with the trip to Neptune and "life" on Neptune. "The Universe Wreckers" is certainly the best interplanetary story by this author that we have published thus far.*

Illustrated by WESSO

CHAPTER I

A Warning of Doom

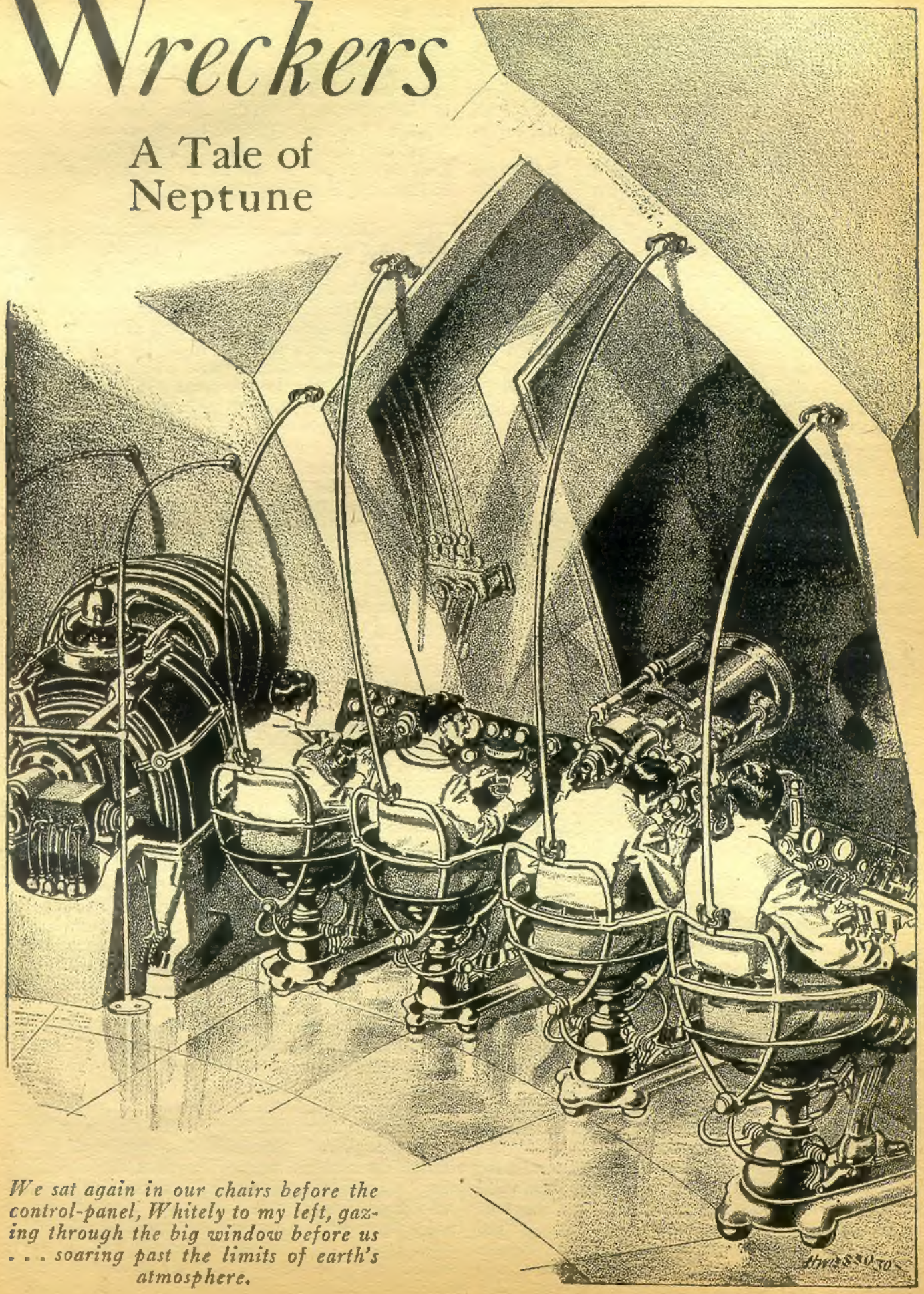
IT was on the third day of May, 1994, that the world received its first news of the strange behavior of the sun. That first news was contained in a brief message sent out from the North American Observatory, in upper New York, and signed by Dr. Herbert Marlin, the observatory's head. It stated that within the last twenty-four hours a slight increase had been detected in the sun's rotatory speed, or rate of spin, and that while that increase might only be an apparent one, it was being further studied. That brief first message was broadcast, a few hours later, from the Intelligence Bureau of the World Government, in New York. It was I, Walter Hunt, who supervised the broadcasting of that message at the Intelligence Bureau, and I remember that it seemed to me of so little general interest that I ordered it sent out on the scientific-news wave rather than on the general-news wave.

Late on the next day, however—the 4th—there came another report from the North American Observatory in which Dr. Marlin stated that he and his first assistant, an astronomical student named Randall, had checked their observations in the intervening hours and had found that there was in reality a measurable increase in the sun's rotatory speed, an increase somewhat greater than had been estimated at first. Dr. Marlin added that all the facilities of the observatory were being utilized in an effort to determine the exact amount of that increase, and although it seemed at first glance rather incomprehensible, all available data concerning it would be gathered. And at the same hour, almost, there came corroborative reports from the Paris and Honolulu Observatories, stating that Dr. Marlin's first observations had already been confirmed independently by their own observers. There could be no doubt, therefore, that the sun was spinning faster!

To astronomers this news of the sun's increased rotatory speed became at once a sensation of the first importance, and in the hours following the broadcasting of Dr. Marlin's first statement, we at the Intelligence Bureau had been bombarded with inquiries from the world's observatories regarding it. We could only answer those inquiries by repeating the statement already sent out on

Wreckers

A Tale of Neptune



We sat again in our chairs before the control-panel, Whitely to my left, gazing through the big window before us . . . soaring past the limits of earth's atmosphere.

the scientific-news wave and by promising to broadcast any further developments instantly from our Bureau, the clearing-house of the world's news. This satisfied the scientifically-minded, while the great mass of the public was so little interested in this slight increase in the sun's rate of spin as not to bother us with any questions concerning it. I know that I would have taken small interest in the thing myself, had it not been for a personal factor connected with it.

"Marlin!" I had exclaimed, when the Intelligence Chief had handed to me that first report for broadcasting. "Dr. Herbert Marlin—why, he was my astronomy prof up at North American University, two years ago."

"Oh, you know him," the Chief had remarked. "I suppose then that this statement of his on the sun's increased rate of spin is authentic?"

"Absolutely, if Dr. Marlin gave it," I told him. "He's one of the three greatest living astronomers, you know. I became good friends with him at the University, but haven't seen him for some time."

So that it was with an interest rather unusual for me, that I followed the reports on this technical astronomical sensation in the next few days. Those reports were coming fast now from all the observatories of earth, from Geneva and Everest and Tokio and Mexico City, for almost all astronomers had turned their interest at once toward this unprecedented phenomenon of the sun's increased rate of spin, which Dr. Marlin had been first to discover. The exact amount of that increase, I gathered, was still somewhat in doubt. For not only did the sun turn comparatively slowly, but the problem was complicated by the fact that it did not, like the earth or like any solid body, rotate everywhere at the same speed, but turned faster at the equator than at its poles, due to its huge size and the lack of solidity of its mass. Dr. Marlin, however, stated that according to his observations the sun's great fiery ball, which had rotated previously at its equator at the rate of one rotation each 25 days, had already increased its rate of spin, so as to be turning now at the rate of one rotation each 24 days, 12 hours.

This meant that the sun's rotatory period, or day, had decreased 12 hours in three earth-days, and such an unprecedented happening was bound to create an uproar of excitement among astronomers. For to them, as to all, who had any conception of the unvarying accuracy and superhuman perfection of the movements of the sun and its worlds, such a sudden increase of speed was all but incredible. And when on the fourth day Dr. Marlin and a score of other observers reported that the sun's rotatory period had decreased by another 4 hours, the excitement of the astronomers was unprecedented. A few of them, indeed, sought even in the face of the recorded observations to cast doubt on the thing. The sun's rotatory speed, they contended, could be measured only by means of the sun-spots upon its turning surface, and it was well known that those sun-spots themselves often changed position, so that this sudden increase in speed might only be an illusion.

This contention, however, found small support in the face of the indisputable evidence which Dr. Marlin and his fellow-astronomers had advanced in the shape of numerous helio-photographs and time-recordings. The sun was spinning faster, that was undoubted by the greater part of the world's astronomers—but what was making it do so? Was it due to some great dark body passing the solar system in space? Or was it due to strange changes within the sun's great fiery sphere? It was the latter theory, on the whole, that was favored by most astronomers, and which struck me at the time as the most plausible. It was generally held that a great shifting of the sun's inner layers, a movement of its mighty interior mass, had caused this sudden change in speed of rotation. Dr. Marlin himself, though, when questioned, would only state that the increased rate of spin was in itself beyond doubt but that no sound theory could as yet be formed as to the phenomenon's cause.

AND while the astronomers thus pondered and disputed over the thing, it had begun to arouse repercussions of interest in the non-scientific public also. More and more inquiries concerning it were coming to us at the Intelligence Bureau in those first few days, those inquiries becoming so numerous as to cause us to switch the news on the thing from the scientific-news wave to the general-news wave, which reached every communication-plate in the world. It was, no doubt, out of sheer lack of other topics of interest that the world turned thus toward this astronomical sensation. For sensations of any kind were rare now in this peaceful world of ours. The last mighty air war of 1972, which had ended in the total abolition of all national boundaries and the establishment of the World Government with its headquarters in the new world-capital of New York, had brought peace to the world, but it had also brought some measure of monotony. So that even such a slight break in the order of things as this increase in the sun's rate of spin, was rather welcomed by the peoples of the world.

And now, the thing had passed from the realm of the merely surprising to that of the astounding. For upon the fifth and sixth days had come reports from Dr. Marlin and from the heads of the other observatories of the world that the strange phenomenon was still continuing, that the sun's rotatory speed was still increasing. In each of those two days, it was stated, it had decreased its period of rotation by another 4 hours, the same daily decrease noted previously. And the exactness of this decrease daily, the smoothness of this strange acceleration of the sun's spin, proved that the acceleration could not have been caused by interior disturbances, as had at first been surmised. A great interior disturbance of the sun might indeed cause it to spin suddenly faster, but no such disturbance could be imagined as causing an exact and equal increase in its speed of spin with each succeeding day. What, then, could be the cause? Could it be that in some strange way the universe was suddenly running down?

But while Dr. Marlin and his fellow-astronomers discussed this matter of the phenomenon's cause, it was its effects that had begun to claim the attention of the world at large. For that increase of the sun's speed was already making itself felt upon earth. Even the great storms in the sun's mass, those storms that we call sun-spots, indeed, make themselves felt upon earth by the intense electrical and magnetic currents of force which they throw forth, causing on earth electrical storms and auroras and strange weather-changes. And now all the usual phenomena were occurring, but enhanced in intensity. On the third day of the thing, the 6th of May, there occurred over the mid-Atlantic an electrical storm of such terrific power as to all but sweep from the air

the great air-liners caught in it, the Constantinople-New York liner and a grain-ship bound from Odessa to Baltimore having been forced down almost to the sea's surface by the terrific air-currents. Great auroras were reported farther south than ever before, and over all our earth changes in temperature were quick and sudden. And among the other new phenomena called into being, apparently by the sun's increased spin, were the new vibrations discovered at that time by Dr. Robert Whitely, a prominent physicist and a colleague of Dr. Marlin's at North American University.

Dr. Whitely's report, though rather obscured in interest by the central fact of the sun's increased speed of spin, was yet interesting enough to physical students, for in it he claimed to have discovered the existence of a new and unknown vibratory force, emanating apparently from the disturbed sun. This was, he claimed, a vibration whose frequency lay in the octaves between light and Hertzian or radio vibrations, an unexplored territory in the domain of etheric vibrations. Dr. Whitely himself had for some time been endeavoring to push his researches into that particular territory, but though he had striven with many methods, he had been able to produce or find no etheric vibrations of that frequency until the strange increase of the sun's rotatory speed had begun. Then, he stated, his instruments had recorded new vibrations somewhere out in space toward the sun, whose frequency lay between the light and Hertzian frequencies, and which seemed a force-vibration of some sort, weak reflections from it only being recorded by his instruments. It seemed possible, he stated, that this strange new force-vibration was being generated somewhere inside the disturbed sun itself, and he was studying it further to determine the truth of this theory.

This discovery of Dr. Whitely's, however, interesting though it was, seemed to be but a side-issue of the real problem, the acceleration of the sun's rotation. After the sixth day, there were no further reports from Dr. Marlin and his fellow-astronomers. During all the seventh and eight and ninth days there came no word to the Intelligence Bureau regarding it, from any of the astronomers who had formerly reported to us on it. And though we got into touch with Dr. Marlin and the others by communication-plate, none of them in those three days would make any statement whatever on the thing, saying only that it was being carefully studied by them and that a statement would be issued soon. It was evident from this universal sudden silence on their part that the astronomers of the world's observatories were acting in conjunction, but why they should want to withhold from an interested world the news on this strange acceleration of the sun's spin, we could not understand. The great electrical storms and temperature-changes that had prevailed over earth continued, and we were anxious to know how much longer we might expect them to continue.

"One would think that Dr. Marlin and the other astronomers had some great secret they were keeping from us," I remarked to Markham, the Intelligence Chief, and he skook his head.

"Secret or not, Hunt, they're doing us out of the first unusual news-subject we've had for a year," he said. "Why don't they give us whatever they've learned about this change in the sun's rate of spin?"

It was a question repeated by more than one in those days, for the great public having become interested in the matter was irritated by this silence on the part of Dr. Marlin and his fellow-scientists. Whatever they had learned or guessed as to the thing's cause, why did they not give their information to the Intelligence Bureau for distribution to the world? It was hinted freely that the whole matter was a hoax devised by Dr. Marlin, which had duped the astronomical world for the time being, and which they were reluctant to acknowledge. It was suggested also that the World President or the World Congress should take action to make the astronomers give out their usual reports. The public was quickly working itself into a state of indignation over the matter, when there suddenly burst upon it that doom-laden and terrible statement by Dr. Marlin, which was to loose an unprecedented terror upon the peoples of earth.

IT was on May 13th, the tenth day after Dr. Marlin's first announcement of the thing, that he gave to the world through the Intelligence Bureau that epochal statement, and in it he referred first to his silence and to the silence of his fellow astronomers in the preceding few days. "In those days," he said, "every observatory in the world has been engaged in an intensive investigation of this acceleration of the sun's rotation, which I discovered. And in each of those days the sun's rotatory speed has continued to increase at exactly the same rate! In each day that speed has increased so much as to cut down the sun's rotatory period 4 hours more, so that now, ten days after the beginning of the thing, its rotatory period has been cut down by 40 hours. In other words, ten days ago the sun turned as it had always turned to our knowledge, at the rate of one turn in every 25 days, at its equator. Now the sun's rotatory speed has increased to the rate of one turn in every 23 days, 8 hours.

"And that increase of rotary speed continues. With each passing day the sun's rate of rotation is growing greater by the same amount, with each passing day it is lessening its rotatory period by 4 hours. And that steady increase of rotation of the sun, if it continues, spells destruction for the sun as we know it! All know that the sun in rotating generates in its own mass a certain amount of centrifugal force, force which tends to break up its mass. That force is not large enough, however, in our own sun to affect its great mass, since our sun's speed of rotation is not great. We know that over vast periods of time a sun's rotatory speed will increase, due to the slow shrinkage of its mass, and that when the speed has increased to a point where its centrifugal force is greater than its own power of cohesion, the sun breaks up like a bursting flywheel, breaks up or divides into a double or multiple star. Thousands upon tens of thousands of the stars of our universe are double or multiple stars, having been formed thus from dividing single suns, whose speed or rotation became too great.

"But as I have said, our own sun seemed in no danger of this fate, since the natural increase of a sun's rotatory speed, due to the shrinkage of its mass, is so unthinkably slow, requires such unthinkable ages, that it is out of all concern of ours. For our sun has rotated once in 25 days at its equator, and it has been calculated that it would need to reach a rotatory speed of once in one hour before its centrifugal force would be great enough to divide it, to break it up. And because of that eon-long slowness of a star's natural increase of rotatory speed, there seemed, indeed, no slightest peril of our own sun dividing or breaking up thus, because before it could

reach that speed of rotation required, unthinkable ages must elapse.

"But now, due to some cause, which none of us have been able to guess, some great cause utterly enigmatic and unknown to us, our sun's rotatory speed has begun suddenly to grow greater, to increase! Faster and faster every day the sun in spinning, its speed of rotation increasing by the same amount each day, its rotatory period decreasing by exactly 4 hours each day! You see what that means? It means that if the sun's speed of spin continues to increase at that steady rate, if its rotatory period continues to decrease by that amount each day, as it shows every sign of doing, within 140 days more the sun's rate of rotation will have increased so much that it will be turning at the rate of one turn in one hour, will have reached that speed at which our calculations show that its great mass can no longer hold together! So that 140 days from now, if this increase of rotatory speed continues, our sun will infallibly divide into a double star!

"And that division means death for earth and almost all its sister-planets! For when the sun divides into two great new suns, the first force of their division will send those two mighty balls of fire apart from each other, and pushing thus apart from each other, they will inevitably engulf in their fiery masses all the inner planets and most of the outer ones! Mercury, Venus, Earth and Mars will undoubtedly be engulfed in the fires of the two dividing suns upon their first separation, their first division. Jupiter and Saturn and very probably Uranus will be drawn inevitably into fiery death also in one or another of those great suns, if they too are not overwhelmed in the first separation. Neptune alone, the outermost of all the sun's planets, will be far enough out to escape annihilation in the dividing suns when the terrific cataclysm occurs. For if the sun continues to spin faster, as it is now doing, that cataclysm must inevitably occur, and must as inevitably plunge our earth to fiery doom and wreck our solar system, our universe!"

CHAPTER II

To Neptune!

"DOOM faces us, a fiery doom in which the dividing sun will annihilate earth and most of its sister-planets! Panic even now grips all the peoples of earth, such panic as has never been known before, as that doom marches inevitably toward them! Yet inevitable, inescapable as that doom seems, we of the World Congress, we who represent here all the gathered peoples of earth, must endeavor to find even now some last chance of lifting this awful menace from us!"

The World President paused, his dark, steady eyes searching out through the great room at whose end, upon a raised platform, he stood. Behind him on that platform sat a row of some two-score men and women, garbed like himself and all others in the modern short and sleeveless garments of differing colors, while before him in the great room stretched the rows of seated members of the great World Congress, the twelve hundred men and women who represented in it all the peoples of earth. Just beneath the great platform's edge sat Markham, the Intelligence Chief, and myself; before us were the switches that controlled the communication-plates throughout the room that broadcast all proceedings in it to the world. And sitting there, I could glance up and see among those two-score behind the World President two figures well known to me; the strong figure of Dr. Marlin, with his intense gray eyes and gray-touched hair; and the lounging, dark-haired form of Dr. Robert Whitely, his somewhat sardonic countenance and cool eyes turned now with keen interest toward the World President before him. And as the latter began again to speak my own gaze shifted toward him.

"It has been just three days," the World President was saying, "since Dr. Herbert Marlin and his fellow-astronomers gave to the world a warning of this doom that hangs above it, gave to us a warning that in less than five months more, if the sun's rotatory speed continues to increase, it must inevitably divide into a double star and in so doing wreck our universe and plunge most of its planets into fiery death. I need not speak now of the terror that has reigned over earth since that announcement. It is sufficient to say that the first wild riots, inspired by that terror in Europe and Northern Asia, have been suppressed by the dispatch of police cruisers, and that throughout the world order is being maintained and most of our world's activities are being carried on as usual. Yet it is clear to all that the panic which that statement inspired has not subsided, rather it is growing in force over the earth's surface with the passing of each day. For each day is bringing our earth nearer to death!

"For each day, each of these three intervening days, the sun's speed of rotation has continued to increase by the same exact amount! Each day its rotatory period has decreased by 4 hours more! It cannot be doubted then that whatever is causing this strange acceleration, it will keep on, until in a mere 137 days from the present, the sun's rotatory period will have reached the figure of one hour. When that occurs our sun will, as Dr. Marlin has warned us, divide into a double star! Nothing in the universe can save our earth or its neighboring planets then. Our one hope, therefore, to save ourselves, is to prevent that thing from happening, to halt this acceleration of the sun's spin before it reaches its critical point 137 days from now! For it is only by halting that steady increase of its rotatory speed that we can avoid this terrific cataclysm that means death for us!

"But can we halt this acceleration of the sun's spin when none of our astronomers has been able to ascertain its cause? That is what you will ask, and in answer to that I say, some hours ago two of our scientists *did* ascertain that cause. They learned at last what great, what almost incredible cause is responsible for this acceleration of our sun's rotatory speed. Those two scientists are well known to all of you, for they are Dr. Herbert Marlin himself, who first discovered the fact of the sun's faster spin, and Dr. Robert Whitely, his physicist-colleague, who has been studying the new vibrations recorded by his instruments since the beginning of that acceleration of the sun's rotatory speed. These two men have found, at last, the terrible cause of our sun's strange behavior, and it is that you might hear it that I have called you of the World Congress together at this time. It is Dr. Marlin himself, then, who will tell you what he and his fellow-scientist have discovered."

The World President stepped aside, and as he did so Dr. Marlin rose, stepped forward to the great platform's edge, and looked quietly out over the great room's occupants. I was aware as he did so of a quality of utter

tension in all the hundreds in that room, of a hushed silence, in which the slightest sound seemed unnaturally loud. Through the great windows there came a deep hum of sound from the sunlit surrounding city, but in the big room itself was silence almost complete until Dr. Marlin's strong, deep voice broke it.

"It was thirteen days ago," he said, "that the acceleration of our sun's rotatory speed was first noted, thirteen days ago that it first began to spin faster. In those days we of the world's observatories have sought unceasingly for the cause, whatever it was, that was behind this strange acceleration of the sun's spin, and have sought for that cause even more intently in the last few days, since it was recognized by us, that this increasing rotatory speed foreshadowed the division of the sun and the doom of almost all its planets. That acceleration of speed was too exact, too uniform each day, to be the result of interior disturbances. It could not be the result of the influence of some dark body passing the solar system in space, for such a body would affect the planets also. What, then, could be the thing's cause? That is what I and all astronomers have been seeking to solve in the last days. That great enigma has finally been solved, not by an astronomer, but by a physicist—by Dr. Robert Whitely, my fellow-professor at North American University.

"It will be remembered that when the first great effects of the sun's increased spin became apparent on earth, the great electrical storms and temperature-changes that still are troubling earth, Dr. Whitely announced the discovery of new vibrations which were apparently emanating from the troubled sun also. That new vibration lay in frequency between the Hertzian and the light vibrations, an unexplored territory in the field of etheric vibrations. It seemed, Dr. Whitely then stated, a force-vibration of some sort, the weak reflected impulses from it, that reached his instruments, affecting them as tangible force. It seemed reasonable to suppose, therefore, that this new force-vibration or ray was being generated inside the sun's disturbed mass, just as light-vibrations and heat-vibrations and cosmic ray-vibrations and many others are generated by and radiated from the sun.

"IN the next days, however, Dr. Whitely continued to study this new vibration, and endeavored to trace it accurately to the sun by using recording instruments which recorded it as strongest or weakest in various quarters of space. By means of these instruments, he was able to plot the course of this force-vibration or ray in space, to chart the path of its strongest portion in space. And by doing this he found that this new force vibration, contrary to his expectations, was not being radiated out equally in all directions as one might expect. It was being shot forth in a great force-beam or ray, one which cut a straight path across half our solar system! And that mighty force-ray, whose weaker reflected pulsings only struck his instruments here on earth, was not being generated and shot forth by the sun, but was *striking* the sun! And tracing its path out across the solar system by his charts he found that the great force-ray was being shot out from the planet Neptune, was stabbing across the great gulf from Neptune, the outermost planet, and striking the sun!

"And it was that giant force-ray, as Dr. Whitely and I soon saw, that was and is making our sun's rotatory speed steadily increase! For that great ray, as we found, is one that can stab across space and strike any object with terrific force, as though it were solid and material! You know that even light rays, light vibrations, exert a definite pressure or force upon the matter which they strike. Well, these force-vibrations, of greater wave-length than the light vibrations, also exert pressure and force upon any matter which they strike, but they exert an infinitely greater pressure, can stab across the vast void and strike any object with colossal and unceasing pressure. In this way, then, this great force-vibration or ray hurtles across space and strikes all matter in its path with terrific force, as though a solid arm were pushing across the gulf.

"And this terrific ray of force, stabbing in through the solar system from Neptune, was striking our sun just at its edge, just at its limb, at its equator. It struck that edge turning always away from Neptune, and striking that turning edge of the sun with terrific force as it did, the great pushing ray made it turn even faster away from Neptune at that edge, made the sun turn faster and faster! Pressing always upon the turning sun's edge with the same great power, this mighty force-ray has made the sun rotate faster each day, has made its rotatory speed increase by the same amount each day. And since that great ray is still stabbing across the gulf from Neptune to the sun, is still accelerating the sun's spin, it is to that ray that we will owe the division of our sun into two parts, 137 days from now, and the consequent wrecking of our solar system!

"For Neptune alone will escape the cataclysm that will take place when the sun divides, and it is from Neptune, from intelligent beings on Neptune, there can be not the slightest doubt, that this great force-ray comes. For it cannot be doubted for an instant that this mighty force-ray is the work of intelligent creatures upon Neptune. Never in all the many discussions concerning the possibility of life on the other planets have astronomers conceded any possibility of life on Neptune, the outermost of the sun's worlds, for though we have always known it to have air and water, its great distance from the sun must needs make it so cold a world as to be unable to sustain life. That was our belief before, but now with this great ray from Neptune swiftly wrecking our solar system before our very eyes, we can no longer doubt that life, intelligent life, exists there!

"It is the beings of Neptune, therefore, the creatures of the sun's outermost world, who are making the sun spin faster and faster, who are deliberately planning to make our sun divide into a double star, to wreck its universe! What their reason is for doing this, we cannot now guess. We know that Neptune, almost alone among the sun's planets, will survive the great cataclysm of its division, and we can but hazard the thought that it is for some great advantage to themselves that the Neptunians are engaged upon this colossal task. Neither can we guess just how, exactly, they are doing it, how they are able to push against the sun with such colossal force without Neptune itself being pushed out into the void by the tremendous reaction from that push. But these things are not of the greatest interest to us now.

"The thing of greatest interest to us now is this: Can we halt this acceleration of the sun's rotation, can we thwart the doom which the Neptunians would loose upon us? To do that there is but one remedy! That is to bring to an end this great force-ray which the beings of Neptune are playing upon our sun's edge, with which they are making that sun turn faster. And to bring

that ray to an end, to destroy it, it is necessary that we go out to Neptune, to the source of that great ray. For it is only at its source, whatever that source may be, that this force-ray can be destroyed! And it is only by destroying that force-ray that earth and its sister-planets can be saved!

"This proposition, this plan to go out to Neptune itself, may seem to you impossible. For greatly as our scientific knowledge has risen in the last decades, we have been unable to bridge the gulf to even the nearest of the planets. True, we have managed to send rockets to our moon and explode flares there by means of them, but never yet have any of us reached even the nearest of our neighboring planets. And thus to propose to go out to Neptune, the farthest and outermost of all the planets, the last outpost of our solar system, may appear to you quite senseless. But it is not so, for now, at last, there is given to us the power to venture out into the gulf of space to other planets! And that power is given to us by the very doom that now threatens us, since it is the force-ray or vibration with which the beings of Neptune are turning our sun faster, which we can use to cross the gulf of space!

"For since his instruments first received and recorded that vibration, the weak reflected pulsings of the great ray, Dr. Whitely has studied it intensively, and has been able, by reversing the hook-up of his receiving and recording instruments, to produce similar vibrations, a similar ray, himself! He has been able to devise small generators which produce the same force-ray, and on that principle larger generators also can be devised and constructed, to shoot forth a force-ray of immense power. With such a force-ray, generated from inside a strong, hermetically-closed flier, one could shoot out at will into the great void! For if such a flier, resting on earth, turned its powerful ray down upon earth, that ray would strike earth with terrific force. Being so vast in mass, and the flier from which the ray is shot down being so small, it would not be earth that would be perceptibly moved by the ray, but the flier itself would be shot instantly up and outward into space by the ray's great pushing reaction!

"It would be necessary only to head the space-flier out toward the desired planet upon starting, and the pushing force of the great ray, constantly turned on, would so accelerate the flier's speed that it would be pushed out toward that planet at a terrific velocity, a speed which could be controlled by the power of the pushing ray. To escape the attraction of other planets among which it might pass, the space-flier would need only to shoot a similar great force-ray out toward whatever planet was attracting it, and the pushing force of that ray would hold the flier out from it. And when the space-flier neared the planet that was its goal, it could gradually slow its progress by means of a ray shot ahead toward that planet, braking its forward rush thus, and being able to land smoothly and without harm upon that planet!

"Such a space-flier as that might be built and operated in that way, with the great force-ray or vibration of the beings of Neptune to propel it, and in such a flier it would be possible to go out across the gulf to Neptune itself! Such a flier, pushing itself out into space with a great ray, could be brought to such colossal speeds that the journey out through the gulf to the distant planet could be accomplished in but a score or more of days. We have the power to build that flier, we have at last, at this tense moment, the power to send such a space-flier out into the void. And I propose that such a space-flier be built with the greatest speed possible and be sent out to Neptune to locate and if possible to destroy the source of the mighty force-ray whose colossal power is spinning our sun ever faster, threatening earth and most of its sister-planets with a final doom!

"A SINGLE space-flier capable of holding three or four men and their equipment and supplies, could be built in a month or more, if all energies were concentrated upon it, and if the great generators of the force-ray which it would need could be constructed in that time. That single flier, when built, should be sent out to Neptune at once! For little enough time remains to us before the break-up of our sun; little more than four months indeed. And that single flier, going out with its occupants at once, could locate the source of the mighty force-ray on Neptune, and if it could not destroy that ray's source, could at least return to earth with exact knowledge of its position. And in the interval, there could be constructed here on earth a fleet of such space-fliers, so that with a knowledge of the great ray's source these might be able to destroy it. All depends, however, upon constructing and sending out that first space-flier, while there is yet time!

"It would not be possible to construct a large space-flier in the short time of a month that I have mentioned, but a small one capable of holding four men, say, could be built in that time if all efforts were concentrated upon it. And I myself will be one of those four! For upon disclosing this plan to the World President, I was asked by him to be the commander of such a space-flier on its venture out to Neptune; and I accepted! Another of that four must be Dr. Whitely, whose discovery of the great force-ray from Neptune has shown us whence our doom is coming, and which discovery has alone made such a space-flier possible. It is my intention to take as a third my own assistant, Allen Randall, and as the fourth person to make this momentous voyage it would be best, no doubt, to have some younger member of the Intelligence Bureau, so that a complete report on the great ray's source and on all else encountered could be brought back, in case we were unable to destroy the ray ourselves.

"This, then, is the one chance for our earth, that in such a space-flier or fliers we of earth can go out to Neptune and put an end to that mighty force-ray from Neptune that is spinning our sun ever faster. For if we can do that, if we can construct such a space-flier or fliers and reach Neptune and bring an end to that ray before the 137 days left to us have elapsed, we will have halted this acceleration of our sun's spin, will have prevented its division. But if we cannot do that, if we are unable in the short time remaining to us to accomplish the task of destroying that mighty force-ray, then the beings of Neptune will have accomplished their colossal purpose, will have caused our sun to divide into a double star and will have sent all its planets except Neptune to a fiery doom!"

Dr. Marlin's strong voice ceased, and as it did so an utter silence reigned over the great room for some moments, broken at last by the voices of the twelve hundred members of the great World Congress—breaking into a vast, indistinguishable roar! My heart was pounding at what I had heard, and I turned, spoke swiftly to Mark-

ham beside me, and then as he nodded was leaping up myself upon the great platform! Was leaping up to where Marlin was standing now with Dr. Whitely and the World President, the whole great room trembling now with the cheering shouts with which those in it greeted Dr. Marlin's announcement. And there I was speaking rapidly to the World President, and to Dr. Marlin.

"The fourth man, sir!", I cried. "The fourth man that's to go in the space-flier—let me be that fourth!"

The World President, recognizing me, turned inquiringly toward Dr. Marlin, who nodded, placing a hand on my shoulder. "Hunt is from the Intelligence Bureau," he said, "and he's young and has had scientific training—was one of my own students. We could have no better fourth."

My heart leaped at his words, and then the World President nodded to me. "You will be the fourth then, Mr. Hunt," he said, shaking my hand. And as I stood there on the platform with Marlin and Dr. Whitely, the World President was turning back to the hundreds of shouting members, a sea of faces extending back to the great room's walls. Cheering as they were at this last chance to save earth and its peoples that had been proposed to them, this last hope given to them to halt the terrible doom overshadowing them, their great uproar yet stilled for a moment as the World President turned toward them, as his voice went out to them over the great room.

"You, the members of the World Congress," he said, "have heard that which Dr. Marlin has told you. With this last hope in view, it is unnecessary for me to tell you to bend now all the world's energies toward that one chance, toward the construction of the first space-flier. For since upon that space-flier rests the only chance to save earth, to prevent the sun's cataclysmic division, which this great ray from Neptune is accomplishing, I have no fear but that in a month from now that space-flier will be completed. Have no fear but that in it, a month from now, Dr. Marlin and his three friends will start on their unprecedented and momentous voyage out from earth into space; will start on their great flight out through the void—to Neptune!"

CHAPTER III

The Space-Flier Starts

"THREE more days and the last work will be done—the space-flier will be finished!"

It was Dr. Marlin who spoke and Whitely beside him, nodded. "Three more days," he said, "and we'll be starting."

We four, Marlin and Whitely and Randall and myself, were standing on the flat roof of the great World Government building, that gigantic cylindrical white structure that looms two thousand feet into the air at the center of the new world-capital, New York. All around us there stretched the colossal panorama of New York's mighty cylindrical buildings, each rearing skyward from its little green park, extending as far away as the eye could reach, many of them rising on great supporting piers out of the waters of the rivers and bay around the island. In the late afternoon sunlight above them there swirled and seethed great masses of arriving and departing aircraft, unfolding their helicopter-vanes from their long hulls as they paused to rise or descend, seeming to fill the air, while away to the south the great Singapore-New York liner was slanting smoothly down toward the great flat surface of the air-docks. Yet it was to none of these things, nor to the masses of humans that swarmed and crowded in the city's streets far beneath us, that we four were giving our attention at that moment, for we were gazing intently at the great object that stood on the roof before us.

That object was a great gleaming metal polyhedron that loomed in a supporting framework beside us like a huge ball-like faceted crystal of metal. This great faceted ball of metal, though, was fully thirty feet in diameter, and here and there in the great, smooth, faceted, plane-surfaces of it were set hexagonal windows of clear glass, protected by thick raised rims of metal around them. There were also set in six of the facets six round openings a foot in diameter, one of these being in the faceted ball's top, one in its bottom, and four at equi-distant points around its equator. In one of the flat facet-sides, also, was a screw-door of a few feet diameter that now was open, giving a glimpse across a small vestibule-chamber inside through a second open screw-door into the great polyhedron's interior. That interior seemed crowded with gleaming mechanisms and equipment, attached to the inner side of the great metal shell.

Marlin was contemplating the great thing intently as we stood there on the roof beside its supporting framework. "Finished—in three more days," he repeated. "Everything's ready for the last generator."

"That will be done in two days more," said Randall, beside me. "Everything else at the World Government's laboratories has been suspended in order to get these generators ready for us."

"They've worked fast to get three of the generators in the flier already," Marlin acknowledged. "Especially since Whitely here, in directing them, had only his own first crude models to work on."

"Lucky we are to get the generators completed and the space-flier finished in the month we estimated!" I exclaimed. "If the whole world hadn't centered its energies on the space-flier's completion we'd never have done it—and even so it's been a tremendous task."

It had, indeed, been a period of tense and toiling activity for Marlin and Whitely and Randall and me, that time of four weeks that had elapsed since Marlin had proposed his great plan to the World Congress. In those weeks all our efforts, and all the efforts of the world too, it seemed, had been concentrated upon the building of that space-flier in which we four, first of all men, were to venture out into the great void, to flash out to Neptune in our attempt to halt the great ray that was spinning our sun ever faster to its destruction and to ours. For each day of those four weeks the rotatory speed of the sun had grown ever greater, its rotatory period decreasing by an exact four hours each day. The instruments of Dr. Whitely, too, showed that the mighty force-ray was still playing unceasingly from Neptune upon the turning sun's edge, spinning that sun ever faster. Already the terrific pressure of that great ray had lowered the sun's rotatory period to 18 days, 4 hours, and in hardly more than a hundred days more, we knew, would have brought the sun's rotatory period down to that critical figure of one hour at which it could no longer hold together, at which it would divide into a double star and plunge earth to doom and wreck the solar system.

And with that knowledge, all the world had sought to aid in the construction of our space-flier. Dr. Marlin had directed that construction, aided by his assistant, young Randall, whom I had met for the first time and had found a sunny-haired fun-loving fellow of my own age. And it had been Dr. Marlin who, after consultation with the world's greatest engineering authorities, had chosen for the flier the form of a great polyhedron. Such a form, it had been found, could resist pressure from within and without much better than the spherical form that had been at first suggested, and it was realized that this power of resistance would be necessary. For upon venturing out from earth's gravitation-field into gravitationless space, the very interior stresses of such a space-flier would tend to explode it unless it was braced against those stresses. Also the space-flier was to be shot out through the void and maneuvered in that void by the pushing reaction of its own great force-rays against the earth or other planets, and though that force would thus hurtle the flier out at terrific speed, it would also crumple the flier itself unless it were strong enough to withstand the force-ray's terrific pressure.

WITH the space-flier's form decided and the plans for it drafted, work upon it had begun at once. At the World President's suggestion, it was being set up on the great flat roof of the World Government building. From over all earth had come the world's most brilliant engineers and scientists to aid in its construction, for the world lay still beneath the great shadowing wing of fear that had been cast over it, when the peoples of earth had learned first of the doom that Neptune and its beings were loosing upon the solar system. So that though the world's first wild panic had subsided, it had been replaced by a waxing realization and dread that had made the peoples of earth and their representatives offer to us their help in this plan of ours, which alone held out any chance, however slender, of escape from the annihilation that was nearing earth. Laboring ceaselessly day and night therefore, in picked crews of workers that every few hours replaced each other, Dr. Marlin and Randall and myself and our eager workers had swiftly brought the great space-flier's metal shell into being.

That great crystal-like shell, at Dr. Marlin's suggestion, had been made double-walled, the space between the two walls being pumped to as complete a vacuum as possible so that vacuum might insulate the flier's interior from the tremendous differences in temperature that it would meet in space. For where the sun's heat-radiations struck the flier in space it would be warm, hot even, but those parts in shadow would be subjected to the absolute zero of empty space. Each of these thick double walls, in turn, was itself built up of alternate layers of finest steel and of non-metallic, asbestos-like insulating material, pressed and welded together by titanic forces into a single thickness. And the great faceted wall-sections of the flier, when in place, had been so welded and fused one to the other by the new molecular-diffusion fusing process, that the great ball-like faceted flier might have been and was, in fact, a single and seamless polyhedron, its strength enormous.

In one of the flier's facets was the round screw-door, admitting one through a small vestibule-chambered, and then through a second hermetically-sealing door into the flier's interior. In that interior, all the flier's mechanisms and equipment had been attached directly to the inner side of its great crystal-like ball, with hexagonal windows, made double and of thick unbreakable glass, here and there in the walls, between the mechanisms. Just inside one of those large windows, at what might be called the ball-like flier's front, were ranged on a black panel of several feet in length the space-flier's controls. The most central of these controls were six gleaming-handled levers which controlled the flier's great force-rays, shooting them forth from any one of the six ray-openings in its sides, to send the flier hurtling through space by reaction, or to use against asteroids or other objects as a great weapon. Supported from the wall in front of those levers was a metal chair that swung on pivots and on sliding pneumatic shock-absorbing tubes, a metal strap across it to hold its occupant in it. And the occupant of that chair, with the six force-ray controls before him, thus controlled the flier's flight through space, and could, if necessary, use its great rays as weapons.

To the left of those controls were the recording dials and switches of the four great generators. Those four gleaming cubical generators themselves were attached to the other side of the flier's hollow interior, along with the marvelously compact and powerful Newson-Canetti batteries. Operating from those batteries whose power-stores were almost exhaustless, the generators, when turned on, would generate the great force-vibrations which, of a wavelength higher than that of light vibrations, exerted a terrific pressure or force beside which the pressure of light was as nothing. These vibrations were carried by thick black cables running between the flier's double walls to the projecting-mechanisms inside the six ray-openings, and from those openings the great force-vibrations were released as great force-rays by the operator of the flier's six controls. These great force-rays, we had found, almost equalled the speed of light itself in the velocity with which they shot out from the flier's ray-openings.

In front of the generators' recording dials and switches was suspended a metal chair like that of the control-operator, while between those two was a third chair before which, on the control-panel, were ranged the instruments recording the space-flier's conditions of flight. There was a space-speed indicator, working by means of ether-drift, a set of dials that accurately recorded the gravitational pull of celestial bodies in all directions, inside and outside temperature recorders, inside and outside air-testers, and beside others the controls of a number of the necessary mechanisms attached at different points inside the hollow faceted ball of the flier. Among these were the controls of the flier's air-renovator, which automatically removed the carbon-dioxide from the flier's breathed air by atomic dissociation and replaced it with oxygen from the compact tanks of compressed liquid-oxygen; the controls of the heating-mechanism, which beside its own heating coils was to utilize the heat of the sun on the flier's side in space; and the control of the hooded lights set above the flier's control-panel and mechanisms.

To the right of the control-operator's chair, too, there was a fourth similar chair before which were ranged on the control-panel a compact but extremely efficient battery of astronomical instruments. There was a ten-inch refracting telescope, its lens set directly in the big hexagonal window over the control-panel, the tube of the telescope, thanks to the new "re-reflecting" principle, being but a score or so of inches in length. There was

also a small but efficient spectroscope similarly mounted, a micrometric apparatus for accurate measurements of celestial objects, and a shielded bolometer for ascertaining the radiated heat of any celestial body.

These four metal chairs, suspended there in front of the long control-panel and with the big hexagonal window before and above them, were mounted all upon special shock-absorbing tubes of pneumatic design which would enable us to withstand the pressure of our flier's acceleration upon starting, and the pressure also of its deceleration upon slowing and stopping. Seated in them, we would be able to look forth over the space-flier's controls into the void before us, and since gravitation would be lacking in the flier, once out in space, metal straps across them would hold us in them. Here and there among the mechanisms that lined the ball-like flier's interior, too, were hand-grips by which we could float without harm among the mechanisms and equipment, while the metal bunks attached at one point to the flier's interior were provided with metal straps to hold us in them during sleep.

RANGED among the mechanisms, that lined the flier's interior, were the cabinets that held our stores and special equipment. Among these were ample stores of food in thermos-cans, kept hot thus and obviating all necessity of cooking, the tanks of compressed water, and the extra liquid-oxygen tanks. Also attached to hooks on the walls were the four space-walkers that had been constructed for us to enable us to venture outside of the flier into airless space, if necessary. These space-walkers were cylindrical metal structures seven feet or more in height and three in diameter, tapering at the top to a smooth dome in which were small vision-windows. Each held a small generator of force-vibrations, and an equally small air-renovator. There were two hollow metal jointed arms that extended from the upper part, and on entering the cylinder and closing its base-door one thrust his own arms inside those hollow metal ones. They ended in great pincer-claws that could be actuated by one's own hands inside, while the space-walker itself was moved through the void by its generated force-vibrations being shot out from a small ray-opening in the cylinder's bottom.

Standing inside the hollow, ball-like polyhedron of the flier, therefore, its mechanisms and equipment extended all about and above and beneath one, attached rigidly in every case to the flier's inner surface. That equipment, those mechanisms, indeed, had taxed all the powers of the great World Government laboratories to provide in the short time that was ours, but by a miracle of effort it had been done. And now, as we four gazed up toward the great gleaming faceted thing, resting beside us there in its framework of metal girders, we knew that there remained only the last of the four great generators to be completed, and that in two days more, as Randall had said, that too would be completed and installed and the space-flier would be ready for its final tests and for the start of our great trip. Looking up at the great thing towering there beside us in the waning afternoon sunlight, I was struck with a sudden realization of the stupendousness of the task that we had set ourselves; of the thing that lay before us.

"To go out in that from earth to Neptune—*to Neptune!*—it seems impossible," I said.

Marlin nodded, his hand on my shoulder. "It seems strange enough," he assented, "but to Neptune in three more days we're going, Hunt. For no other chance is there to save earth from the doom marching upon it."

"But *can* we save it?" I exclaimed. "Can we four really hope to contend against beings who, whatever their nature, have power enough to reach across the solar system and speed our spinning sun on to its doom and ours?"

Marlin looked gravely at me, and at Whitely and Randall beside me. "A chance there is—must be," he said solemnly, "even though little time now remains to us. And with that chance—with earth's chance—in our hands, we must strike out to the last with all our power for earth!"

Those words of Marlin, I think, steadied us all in the whirling rush of activities that was ours during the next, the last, three days. For in those three days, as the last generator approached completion and was completed and installed, we four were ceaselessly busy with the last preparations for our start. Whitely, who had designed and was to have complete charge of the space-flier's great generators, was busy inspecting and testing those generators. Randall and I were familiarizing ourselves with the flier's controls, for we two were to alternate in controlling its flight through the void. Marlin, who would not only command our little party but would have charge of the astronomical equipment in it, and would chart our course out through the trackless gulf, was occupied beside numberless other tasks in plotting, with the assistance of some of the world's foremost astronomers, that course that we must follow now. So that as there came upon us the last day of June 16th, that day upon whose night we were to start our momentous journey, it found us working still upon our last preparations.

By the time that day and night had come, too, it found the excited expectation of the world keyed up to an agonized point. For days, indeed, great crowds had swirled about the base of the huge World Government building, on whose roof we worked, and, as the last hours approached, it seemed that all the world's thoughts, indeed, were concentrated upon that roof, upon the great gleaming space-flier on it. For all knew that upon that flier and upon the mission which we four were attempting in it depended the one chance of escape for earth. For steadily, remorselessly, the sun was spinning still ever faster, the great pushing force-ray from Neptune still stabbing across the solar system to spin the sun on and on with greater and greater rotatory speed, until it divided and doomed earth and its sister-planets. So that those last days, those last hours, seemed to all the world as to ourselves to pass with nerve-tearing slowness.

There came at last, however, the night of the 16th, the night of our start, with the space-flier complete and ready in its framework at last. The last work of Marlin and Whitely had been to check over the construction-plans of the flier, which were to be left behind so that a great fleet of space-fliers, as the World President had said, could be constructed. Were we to return from Neptune with knowledge of the position and nature of the great doom-ray's source there, that fleet of space-fliers would be ready to sally out and attempt to bring an end to the great ray. But that knowledge, if we gained it, we must bring back ourselves, since there was no method of communication from our space-flier to earth, the well-known "Heaviside layer" surrounding earth being impene-

trable to all radio and communication vibrations and making such communication impossible. With this last preparation completed, however, we four stood ready upon the night of the 16th for the start of our great venture.

IT was an hour after midnight that we were to start, and it was not until some minutes past midnight that Marlin and Whitely and Randall and I left our quarters in the World Government building and ascended to its roof. As we emerged upon that roof we stopped involuntarily. For the great roof itself and all the surrounding colossal city of New York were lit now with brilliant white suspended lights, and beneath them upon the roof and in the streets far beneath were masses upon masses of waiting men and women. Those upon the roof were the twelve hundred members of the great World Congress, assembled there to see our start out into the void on our desperate venture. At their center was a clear, roped-off space on the roof in which there towered the framework that held our great space-flier, gleaming in the brilliance of the lights about it, and just inside that clear space stood the World President, a half-dozen officials beside him.

As we paused there for that moment, Marlin's face grave and intent with purpose, Whitely coolly looking about him, and Randall and I endeavoring to conceal the excitement that pounded at our hearts, the whole scene was imprinted indelibly upon my brain. The crowds and brilliant lights about and beneath us, the great space-flier's faceted bulk looming into the darkness, the colossal buildings of the great world-capital that stretched away in the darkness in all directions, a great mass of shining lights among which swirled a packed sea of humanity gazing up toward our flier—these formed a mighty panorama about us, but in that moment we turned our gaze up from them, up toward the great constellations of summer stars that gleamed in the black skies overhead. Away in the southern skies, not high above the horizon, burned the equatorial constellations, Scorpio and Sagittarius and Capricorn, with the calm white light-globule of Jupiter moving in Scorpio and the bright red dot of Mars and yellow spark of Saturn in Capricorn. But it was toward Sagittarius that we were gazing, for among that constellation's stars there shone also Neptune, invisible to our unaided eyes but almost seen by us, it seemed, in that tense moment.

Then we four were moving across the roof toward the looming framework that upheld the space-flier, pausing inside its clear space to face the World President. It was a moment of cosmic drama, that moment in which earth and the silent peoples of earth, that had gathered in millions there to watch us, were sending forth four of themselves into the trackless void for the first time, sending them forth with earth's one chance for life in their hands. The World President, facing us, did not speak, though; did not break the thick silence that seemed to lie over all the mighty city. He reached forth, gripped our hands with his own, grasped them tightly, silently, his steady eyes upon ours, and then stepped back. And then Marlin leading, we were clambering up the framework to the flier's screw-door, passing silently inside and then screwing that great door hermetically shut behind us. That done, we passed across the little vestibule-chamber and through the second screw-door, closing it likewise behind us.

Then, clambering up to the four suspended chairs in front of the control-panels, we took our places in them; Marlin in the right chair, his telescope and astronomical equipment before him, I in the next one, with the six controls of the space-flier's movements before me, Randall in the third chair, the recording dials and minor controls of the flier before him, and Whitely in the fourth or left chair, the dials and switches of the generators before him. Seated there, the constellation of Sagittarius and the other southern stars were full before us in our big window, for our space-flier was so supported in its framework that by turning on its great force-ray from the lower ray-opening we would be shot out by the terrific repulsive force straight toward Sagittarius, toward Neptune, slanting out tangent-wise from earth's surface. And now Marlin was peering through the short, strange-looking tube of the telescope, was touching its focusing wheels lightly, peering again, and then turning to me.

"Neptune," he said quietly. "We'll start when it reaches the center of this telescope's field of view—when the flier is pointed directly toward it."

"But we can maneuver the flier in any direction in space, could head out from earth and then toward Neptune," Randall commented, as I applied my own eye to the telescope, and Marlin nodded.

"We can, but by starting straight toward Neptune we'll use less of our generators' power."

While he spoke I was gazing through the telescope, and though I had gazed upon Neptune many times before it was never with such feelings as gripped me now. Like a little pale green spot of calm light it was, floating there in the darkness of the great void, its single moon not visible to me even through the powerful telescope. Then as I straightened from the telescope's eye-piece Marlin had taken it again, gazing intently into it now, to call out to me the moment when the planet reached the center of its field of view, when our space-flier would be headed straight toward it. For it was then, as Marlin had said, that we planned to hurtle out toward the planet with all the power of our great force-rays, not only reacting but pushing against earth as light pushes. But since we must necessarily change our course once in space, to allow for Neptune's own movement among other things, we would use less power by making our first start straight toward it.

Now, as we sat tensely there, I had turned, nodded to Whitely, and he had thrown open the switches before him that controlled the great generators, their throbbing suddenly sounding behind us as they went into operation, generating the force-vibrations that in a moment would be released backward from our flier as mighty force-rays. As Whitely moved the switches, the throb of the generators died to a thin hum, then rose to a tremendous drone, and then slowly sank to a smooth throbbing beat at which he rested the switches. And now Marlin, beside me, was calling out to us the divisions of the specially-designed telescope's field, as Neptune passed across them to the zero mark at which we would hurtle outward.

"—45—40—35—30—"

As his steady voice sounded periodically beside me I sat as though a poised statue, my hand upon that lever among the six lever-switches before me that would send the power of our throbbing generators stabbing out with colossal force from the flier's ray-opening behind us, that

would send that flier hurtling outward. "—25—20—15—." As the calm voice of Marlin broke the silence beside me I felt my heart racing with excitement, saw that Randall, and even Whitely, beside me, had hunched tensely forward as the moment approached. I glanced out a moment through the flier's windows, seeing in a blurred impression the breathless, watching crowds, the brilliant lights. "—10—5—*zero!*" And as that last word sounded I threw open in one swift motion the lever-switch in my grasp!

The next instant there was a colossal roaring about us, we seemed pressed down in our chairs with titanic, crushing force, and saw crowds and lights and great buildings vanishing from about our flier with lightning-like swiftness as a great pale ray of light, of colossal force, stabbed down and backward from the flier's ray-opening behind us!. In a split-second all about us was blackness and then the great roaring sound about us had ceased, marking our passage out past the limits of earth's atmosphere! Now through the windows before and about us, as we clung there, we saw the heavens around us brilliant with the fierce light of undimmed hosts of stars, while as our great flier reeled on at mounting speed into the great gulf, we saw behind and beneath us a great gray cloudy ball that was each moment contracting in size. Earth was receding and diminishing behind us as we flashed out through the void toward distant Neptune, to save that earth from doom!

CHAPTER IV

Through Planetary Perils

"MARS ahead and to the left—we ought to pass it in three more hours!"

At my words Marlin nodded. "We won't be bothered much by the pull of Mars," he said.

We sat again in our chairs before the control-panel, Whitely to my left, gazing through the big window before us. Ahead and above and all around us there stretched a great panorama, stunning in its brilliance, the vast panorama of the starry heavens as seen from the airless interplanetary void. Blazing in their true brilliant colors on all sides of us, the hosts of stars were like jewels of light set in the black firmament. And as our flier throbbed on through the great gulf of empty space at terrific speed, its acceleration still pressing us down somewhat in our chairs, we could see now amid the flaming stars dead ahead the far green spot of light that was Neptune, our goal, visible now to our unaided eyes in the clearness of empty space. Nearer toward us and to the right Jupiter was like a brilliant little disk of white light, now, the four white points of its greater moons visible about it. To the left, too, yellow Saturn shone much brighter, while nearer toward us on the left, almost beside us, hung the dull-red little shield, white-capped at its poles, that was Mars.

Behind us, by this time, earth had dwindled to a steady spot of bluish light that was like a tiny moon, the smaller spot that was earth's moon gleaming near it. Hardly visible as earth was in the blinding glare of the great sun that beat upon us from behind, its great corona and mighty prominences appalling in their splendor, yet it was visible enough to show how far from it out into the void our flier had already flashed. For forty-eight hours indeed, our great space-flier had rushed outward at a speed that had already reached over a million miles an hour, and that was steadily mounting still beneath the terrific reaction of our great force-ray, that great pale ray only visible at its ray-opening source, that was stabbing back with colossal power and by the reaction of that push sending us hurtling on at greater and greater speed. Out and out we had flashed, Randall and I relieving each other every four hours at the controls, and already now had almost reached the orbit of Mars, more than fifty million miles outward. Now, as Marlin and Whitely and I gazed out toward it, the red disk of Mars itself was but several million miles from us, to the left and ahead.

Gazing toward it, we could see clearly the great ice caps of the poles of Mars, brilliant white upon its dull red sphere, and could see clearly also the long straight markings upon it, a network of inter-connecting lines, that for long had been the subject of discussion and disputation among earth's astronomers. It was with fascinated eyes that we gazed toward the red planet as we drew nearer to it, and now Randall had joined us, moving with great efforts against the acceleration-pressure inside the flier. Marlin, though, had turned the telescope by that time toward the crimson planet, was gazing intently toward it. Minutes he gazed before he straightened, shaking his head.

"There can be no doubt that those canals—those lines—are the work of intelligent creatures," he said. "I saw great geometrical forms that seemed structures of some sort, but our space-flier is moving at such tremendous speed that it's all but impossible to get a clear focus on the planet in the telescope."

We stared toward the red disk and its dark markings. "If we could but stop there—who knows what wonders Mars may hold, what science——," Whitely mused.

Marlin nodded thoughtfully. "Neptune's our goal, and we can't stop for Mars now, whatever may be there. But if we succeed in our great task, if earth is saved from this doom that Neptune's beings are loosing on the solar system, we'll come yet to Mars—and to all the others."

"In the meantime," I told them, "Mars is pulling our flier out of its course more and more. I thought our speed would take us by it, but it seems we'll have to use another ray."

For even as we had gazed toward the red planet, I had noted from the dials before Randall that the gravitational pull of Mars upon our space-flier from the left was becoming more and more powerful as we approached it to pass it, and that it was pulling us slowly toward it out of our course toward Neptune. Our deviation to the left was not great as yet, but even the slightest deviation we could not permit, since not only must we head as straight toward Neptune as possible to save time, but it was necessary that we avoid also the colossal force-ray which was stabbing from Neptune across the solar system toward the sun's edge, which was turning that sun ever faster. That great force-ray, invisible to us, but lying away to our left, we knew, would mean death for us if we blundered into it, would drive our flier with titantic force and speed straight into the sun!

So that now, as our space-flier moved nearer and nearer toward the distant red shield of Mars, pulled farther and farther out of its path toward Neptune, I swiftly manipulated the ray-direction dials on the control-panel, then grasped and threw open another of the six ray-opening switches. At once there leaped from

our racing flier's side, from one of its ray-openings there, a second great force-ray like that which stabbed from the flier's rear toward earth. This second ray, though, vaguely visible like the first at its source, but fading into invisibility in space, shot out toward the red sphere of Mars, away to our left. And in a moment more, as that light-swift ray reached Mars and pressed against the red planet with all its force, our flier was being pushed away from it, was being pushed back to the right, back into its original line of flight! Thus we hurtled on, the great rear ray of the flier pushing back with terrific force and sending us hurtling on through space, while the side-ray, striking Mars with lesser force, was sufficient to keep us out of the red planet's grip as we flashed onward.

Within a few hours more Mars was behind us, its red sphere fading rapidly into a crimson spot of light to the left and behind. The planet's two tiny moons, Phobos and Deimos, we had not yet seen despite our nearness to it, but it was with something of regret that we saw the crimson world and all the strange mysteries that we felt existed upon it, dropping behind us. Neptune alone, as Marlin had said, was our goal, and on toward its calm green light-dot we were rushing. I turned off our side-ray, therefore, which was no longer needed to counteract Mars's pull, and we gave all our attention to the panorama ahead. Save for Neptune's distant green dot, the only planets now visible amid the brilliant hosts of stars before us were Jupiter and Saturn. Saturn was shining ever more brightly to the left, its strange ring-formation already becoming visible to our eyes. But it was Jupiter that now dominated all the scene before us, his mighty sphere, its oblateness plainly visible, moving in majestic white splendor at the center of his four great moons.

It was not the planets ahead that held my attention now, though, as our throbbing flier raced onward, Mars and its orbit dropping behind. "The asteroids!" I exclaimed. "We're almost into their region now—will be among them soon!"

"And they're one of the greatest perils we'll encounter," Marlin said. "Hold ready to the controls, Hunt, for if we crash into one it means our end—the end of earth's chance!"

I DID not need his admonition, though, to make me tense my hands upon the control-switches, gazing intently forward. I knew we were now passing into one of the most dangerous regions of all the solar system—that great belt of whirling asteroids that lies between the orbits of Mars and Jupiter. More than a thousand in number, ranging from the great sphere of Ceres, 480 miles in diameter, down to the smallest asteroids of a few miles diameter only, they whirled there around the sun between the four inner and four outer planets, their orbits a maze of interwoven circles and ellipses. The greater part of them were so small, indeed, that at the tremendous speed with which our space-flier was flashing on they could be seen only in the moment that we rushed upon them. And yet in that moment we must whirl aside from any before us, since otherwise, pulled closer by the asteroid's own gravitational power, we would infallibly crash into it and meet our doom.

Steadily, therefore, we watched now, as hour followed hour, as our flier rushed on with speed still slowly mounting, traveling finally at more than two million miles an hour. The throb of its four great generators was as steady as ever, and the pressure of its decreasing acceleration still weighed upon us, but already we had become accustomed to that pressure. So now while I gazed forth with Marlin ahead, Randall was at one of the right windows and Whitely at one of the left, keeping a similar watch. And it was Randall, a few hours later, who sighted the first of the asteroids. He uttered a swift exclamation, pointing to the right and ahead, and as we looked there we saw a small bright point in the blackness of space, a point that with the swiftness of lightning was expanding into a great, dull-gleaming sphere, rushing toward us and drawing our space-flier toward itself! A moment we saw it rushing thus toward us, a great sphere of barren, jagged rock, airless and waterless, turning slowly in space; and then it was looming gigantic just beside us!

In that moment, though, my hand had jerked open one of the six levers before me, and instantaneously had shot from our flier's side a great force-ray toward that looming asteroid beside us. The next instant the asteroid's giant rock sphere seemed to flash away from us and disappear with immense speed, but in reality it was our flier that had been pushed away from the asteroid with colossal force by the force-ray I had shot toward it! Instantly I snapped off that ray, the space-flier flashing on in its straight course as formerly. And as I did so Marlin turned for a moment from his watch at the window toward me, gestured to the right toward the asteroid from which we had so narrowly escaped. In the moment we had seen it, I had estimated that one to be a hundred miles or more in diameter.

"That would be Vesta," he said, "one of the largest. It's the only one of that size in this part of their region now."

"Large or small, I want to see no more of them that close," I said. "Especially when——"

"Hunt!—look—to the left!"

It was Whitely who had cried out to me, and as I whirled to gaze in the direction in which he pointed, I noticed another swift-expanding sphere of rock, another gleaming asteroid rushing obliquely toward us! Not as great in size as the first one, but it was approaching us with terrific speed, and even as I jerked open one of the switches before me, sent a force-ray stabbing from the flier toward the rushing asteroid, it seemed that that asteroid was touching us, its great rocky surface shutting out all the firmament as it towered there beside us! My ray, though, had been shot forth just in time, had whirled us aside from the onrushing monster's path at the last moment, and as we reeled on, it too had vanished behind us. But now I had glimpsed two larger ones ahead and to the left, and was jerking the flier away from them also.

Still we were racing onward, our great space-flier hurtling on and on through that asteroid-filled region, escaping those great rushing spheres of death, sometimes by the narrowest of margins. Hour upon hour, keeping our sleepless watch at the flier's windows, we flashed on, its colossal speed still mounting as more and more of our generators' power was turned into the great rear force-ray that pressed back towards earth and that shot us outward. By that time earth had become but a bright white star behind us, the sun's size and brilliance decreased by a third or more already. But it was not backward we were gazing; it was ahead. We were striving with all our powers to avoid the asteroids that hurtled about us. We saw, once or twice, families or groups

of those asteroids moving together, sometimes dozens together, and strove to give these a wide berth. On we raced, veering now to this side and now to that, with Jupiter looming ever greater ahead and to the right as we approached the end of the asteroidal belt. But it was as we approached its end, at last, that our greatest peril came suddenly upon us. For I had shot the space-flier sidewise with terrific speed to avoid an onrushing small asteroid, and the next moment when it slowed its sidewise rush, found that I had unwittingly shot it into the very heart of a great family of full two-score of the little planets!

All about us in that moment it seemed were asteroids, gleaming spheres at the very center of whose swarm our flier flashed, and into which by some miracle our sidewise rush had projected us, unharmed! I heard the hoarse cries of Marlin and Randall beside me, in that moment, the shout of Whitely, and knew that only another miracle could ever take us out of that swarm unharmed. Already, in that split-second, three of them were looming great to our right, another one ahead and to the left, and to escape one was to crash upon another. There was no time for thought, no time for aught save a lightning-like decision, and in that fractional instant I had made that decision, and as our flier hurtled through the great swarm of asteroids, had shot out its great force-rays to right and left and above and beneath us, driving out in all directions from our flier as it flashed through the great swarm!

There was an instant in which the space-flier seemed to be jerking and flashing in wild aimless flight amid that swarm, as its striking force-rays pushed it now to one side and now to another, away from the asteroids about us. Were two of those rays to strike asteroids in opposite directions, balancing each other, the space-flier, instead of being pushed aside, would be crumpled to instant annihilation between the push of the two great rays, I knew, and we expected nothing but annihilation in that mad moment as we shot on. But after reeling to right and left with dizzy speed for a crazy instant, the asteroids of the swarm had vanished suddenly from about us as we shot out of that swarm! We had escaped, had escaped a death that for the moment had seemed certain to all of us, and that I had managed to evade by instinct and luck rather than by reason.

"Close enough—that!" I exclaimed as we raced forward through the void on our straight course once more. "If we meet many more swarms like that, our chances of getting to Nepture are small!"

Marlin shook his head. "We seemed gone that time," he admitted. "But I think we're almost out of the asteroidal region now—we should be crossing Jupiter's orbit in another twenty-four hours."

"The space-flier's doing four million miles an hour now," I said, glancing over at the space-speed dial. "We're beginning to feel Jupiter's pull a little already."

We were, indeed, already deviating a little to the right from our straight course in answer to the gravitational pull of the tremendous mass of Jupiter, looming ever greater now ahead and to the right. We were to pass it by some fifteen million miles, more than twice the distance at which we had passed Mars, but the colossal planet, larger than all the other planets of the sun together, was already attracting us strongly despite our terrific speed and momentum. For the time being, though, we gave it but scant attention, concentrating our attention, as we did, upon the watch for farther asteroids, since we had not yet emerged from their great belt between the orbits of Mars and Jupiter. Sleepy and weary as we were from our hours upon the watch, we dared not relax from that watch, and so Whitely and Marlin and Randall still kept up their constant survey of the surrounding void, while I held the flashing space-flier's controls, turning more and more of our generators' power into the great force-ray that was hurtling us on. We had not dared to use the generators' power too swiftly upon our start, lest the too great acceleration kill us, despite our shock-absorbing apparatus. But steadily our speed, already colossal, was mounting, and we were racing on through the gulf toward the distant green spot of light that was Neptune.

ON and on in those hours we shot, until it seemed to me, seated there at the controls, that always we had flashed thus through endless realms of tenantless space. For now but a few asteroids were sighted by our watching eyes, and the eventlessness and strange tension of our rush onward through space made it seem like a strange flight in some unending dream. On and on, with Marlin and Randall and Whitely watching ceaselessly about me, on with the throbbing of our generators beating in my ears in unhalting rhythm. Behind us earth's bright white star was steadily growing smaller, but still our great force-ray, stabbing ceaselessly back from our flier with colossal power, was sending us racing on faster and faster with its huge reacting force. But our start from earth, days, hours, before, the great mission upon which we were speeding outward to Neptune, these things I had forgotten, almost, as the dream-like quality of our onward flight gripped me.

But as we raced still onward, as Jupiter's mighty sphere loomed greater and greater to the right ahead of us, my bemused faculties were shaken into wakefulness by the necessities of our situation. By that time we had passed out of the dangerous asteroidal region, and with their watch no longer necessary Whitely and Randall, after preparing for us all a quick hot meal from the thermos-cans in which all our food supplies were packed, had taken to their bunks for some much-needed sleep. Marlin sat beside me as we rushed on, his astronomical preoccupation holding him to a contemplation of the great planet, despite his own weariness. And weary enough he was, and I too, since for almost forty-eight hours we had been flashing through the perils of the asteroidal belt. It was now the beginning of the fifth day since our start from earth, and already for a hundred hours we had been flashing at tremendous and mounting speed through the airless void. Like Marlin, though, I forgot my weariness in the spectacle of giant Jupiter, to the right and ahead.

For it was a spectacle of magnificence, indeed. Swinging like a giant disk of soft white light in the blackness of space to our right, Jupiter spun amid its four greater moons, the smaller moons being of diameter too small to be seen with unaided eyes even thus close. But of the giant sphere of Jupiter, of that great sphere's surface, nothing was to be seen. For all the mighty planet's surface was covered by the colossal masses of great clouds that enclosed it, floating in its dense atmosphere and encircling it in great belts, the mighty cloud-belts that for long have been to astronomers the most characteristic feature of Jupiter's surface. So that, though Marlin

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with the aid of the telescope, sought to gain a glance through some opening in the clouds at the great planet's surface, he failed in the attempt.

In a moment, however, he concentrated his attention upon the one visible feature upon the mighty world's surface, the great red spot that we could plainly see now as a pink area beneath the shrouding clouds, in the planet's southern hemisphere. At sight of it, Marlin had prepared and trained his spectroscope upon it, but after observations of a few moments he raised his head, perplexed. He glanced about him for a moment, then seized the bolometer, which by virtue of its new "shielded" principle was able to record accurately the amount of heat radiating from any one point of a planet or star, as well as from the whole planet or star. But upon checking its reading for a moment, after turning it toward the pink area of the great red spot, Marlin straightened from it also, shaking his head.

"It's strange, Hunt," he said, turning toward me. "It's always been believed that the great red spot is a part of Jupiter's surface still molten and flaming, but the spectroscope and bolometer show that it can't be."

"Strange enough," I admitted, gazing myself toward that glowing pink area on the mighty planet. "If we could but stop and explore the planet—but we must keep on toward Neptune."

"We must keep on," Marlin repeated, "but some day it may be, if we can save the solar system from the doom that hangs over it now, we'll come back here to Jupiter, will see for ourselves its surface."

By this time the great planet was almost directly to our right, its giant cloudy white sphere seeming to fill all space, despite the fact that it was more than fifteen million miles from us, and its four big, greater moons revolving about it. Hours before I had shot a force-ray toward the great planet from our flier's side, to counteract its growing pull upon us, but now as we came level with it, were passing it, that pull upon us was so enormous that it was only with a force-ray of immense power that I was managing to keep the space-flier from being drawn inward. Passing thus close, Jupiter's stupendous cloud-belted sphere was an awe-inspiring sight, whirling at immense speed also, since the great planet, more than a thousand times greater than earth, rotates upon its axis at hardly more than a third of earth's rotatory period or day, its day being less than ten hours. And passing it thus, too, the great red spot upon its lower half was an even greater enigma, for that gigantic pink oval was, we knew, fully thirty thousand miles in length, greater by far than all our earth.

It was with awe that Marlin and I, and Whitely and Randall who had awakened now to relieve us, stared toward the gigantic monarch of the sun's planets as it dropped slowly behind on our right. A side-ray of colossal power it had taken, indeed, to hold us out from the great world's pull, and only slowly could we decrease that ray's power as we moved farther out from it. But now at well over four million miles an hour, we were flashing out beyond Jupiter's orbit, and ahead there was gleaming brighter to the left the yellow spot of light that was Saturn, the last planet that we must yet pass before reaching Neptune, since Uranus was in conjunction in regard to Neptune, being far on the other side of the solar system from us. And as Randall now took my place at the controls, I pointed toward the little yellow-glowing, ring-circled disk of Saturn ahead and to the left.

"Keep the flier heading straight toward Neptune, Randall," I told him. "We're going to pass Saturn uncomfortably close as it is, and we don't want to take any chances with it."

Randall nodded, his gaze shifting from the steady green spark of Neptune far ahead to the growing yellow disk of Saturn. "I'll try to keep her straight," he said, grinning, "though I'm beginning to wish that, if there's to be trouble, it had come back on Mars or Jupiter."

I smiled a little as I swung back from the control-panel along the flier's inside wall. I went from handhold to handhold with the pressure of its acceleration still upon me, until I had thrown myself into my metal bunk to fall almost instantly asleep, and to dream nightmare dreams of rushing on through endless space toward a goal that ever receded from us. And in the hours that followed, in the next three days that our space-flier shot on and on with Saturn growing ever greater ahead, the nightmare quality of my experience persisted. It seemed impossible, at times, that we four were in reality doing that which men had never done before; that we were flinging ourselves out into the great void, out through the solar system toward the planet that was its last outpost. We were watching and eating and sleeping, indeed, like men in a dream, so strange and utterly unreal seemed to us this unending rush through unending space.

BUT though we slept, and ate, and watched at the control-panel like men in a dream, there were times in those hours when realization of our position, of our great mission, came sharply home to us. Those were the times that Marlin trained his instruments upon the sun, which had by then dwindled to a tiny blazing disk behind us. And with those instruments Marlin found that the sun was still spinning ever faster and faster, its rotator period decreasing still by the same amount each day, its day of division and doom steadily approaching. And with his own recorders Whitely found that the colossal force-ray from Neptune still was stabbing toward the sun, still turning it faster and faster toward its doom and that of its universe. That great force-ray, we found, was stabbing toward the sun on a line between our flier's course and Saturn, but was on a somewhat higher level, so that in reality the great ray did not lie between our flier and Saturn but above both.

The consciousness we had of that great ray's existence and the knowledge we had of the doom it was loosing upon the peoples of our world served to prevent the dream-like lassitude of our conditions from overpowering us, and we were further awakened by the swift expansion of Saturn, ahead, as our flier neared it. For by then the great faceted ball of our flier was hurtling on through the void at five million miles an hour, slowly approaching the limits of its speed as our mighty rear force-ray drove us forward with tremendous power. And at that speed, in the next three days, Saturn loomed larger and larger ahead, until we saw at last that upon the fourth day's beginning we would pass the mighty planet. And at that our interest rose to excitement, because we would pass closer by Saturn than any of the planets in our straight flight out to Neptune, passing it indeed by no more than a million miles. So that as the last hours of those three days passed, we observed the big, yellow-glowing disk of Saturn ahead with intense interest.

And a strange sight indeed was great Saturn as it loomed greater before us and to the left, for strangest of all the suns planets to the eye is this one. Greatest of all the planets save for mighty Jupiter, its huge sphere seemed even greater than Jupiter by reason of the colossal rings that encircled it, and by its nine greater moons that revolved about it. A solar system in itself seemed Saturn, indeed, its huge rings tilted somewhat, those great rings themselves tens of thousands of miles in width and thousands of miles from the planet then encircled. We could see, as we drew nearer toward the great planet, that those rings were in fact what had long been known by earth's astronomers—gigantic flat swarms of meteorites and meteoric material revolving about the great planet at immense speed. Of the surface of Saturn, though, no more could be seen than of that of Jupiter, since like Jupiter the great planet was wreathed in colossal cloud belts.

Marlin shook his head as he gazed toward the great ring-girdled planet, almost filling the heavens beside us. "It is well for us that Saturn is not our goal," he said. "Those titanic meteoric masses that are the rings—to blunder into them would mean instant annihilation."

Whitely nodded. "As it is," he said, "there must be many meteors in this region about Saturn—many that have broken loose from the rings or are flying toward those rings."

"Let's hope that you're wrong on that, at least," I told him. "We'll soon be passing within a million miles of those rings, and I want to meet no meteorites—not after our experience with the asteroids."

By then, indeed, we had drawn almost level with Saturn, its huge sphere and colossal rings almost directly to the left, the edge of those rings, but a half hundred miles or less in thickness, being a scant million miles or more from our racing space-flier. The great maze of the planet's nine greater moons seemed crowded now upon its other side from us, Titan, largest of those moons shining brilliantly as a small white disk near the huge yellow bulk of Saturn and its colossal rings. Before then indeed, I had been forced to shoot out from the flier's side a force-ray toward Saturn, to counteract the great planet's pull upon us, but though it loomed beside us now almost as immense as great Jupiter itself, its recorded pull upon us was many times less. This was due, I knew, to the comparatively small mass of Saturn, since though of immense size and possessing a vast atmosphere, it is known to be the least dense of all the planets, being of less than 0.7 the density of water.

Even so, however, it was requiring a force-ray of great power to hold our rushing flier out from the huge planet. Though lesser than Jupiter's, its pull upon us was great, nevertheless. And now that we were passing the huge world so closely, it seemed to us with its vast rings and great family of whirling moons to be of universe-size itself, so mighty did it loom beside us. The great rings, of small thickness compared to their huge width and circle, were edge-on to us now, a million miles to the left, and we could see that they were in reality but vast swarms of countless meteors, great and small, whirling at great speed about Saturn and forming by their division three rings, the innermost a darker one. Yet despite their strange appearance and colossal size, it was not the great rings that held our interest so much in that moment as the cloud-hidden surface of Saturn itself. For even as in passing Mars and Jupiter, we were gripped with desire to veer in toward the planet and explore the strange wonders that might exist upon it, or upon its greater moons. But none suggested that thought now. All four of us knew that only the growing green spot of light, that was distant Neptune ahead, must be our goal.

AS the flier raced on, almost passing the huge planet now, Randall uttered a swift exclamation, pointing ahead and to the left a little. At the same moment, though, I had seen the thing that had caught his eye—a small dark point growing with lightning swiftness as it rushed toward us; a great dark meteor, perhaps five hundred feet in diameter, rushing toward our flier, whirling far out from Saturn's rings in the same direction as those rings! Instantly, upon seeing it, I had turned more power into the ray that held us out from Saturn, and as we were pushed sidewise in the next moment by that increased power, the big meteor had flashed past us far to the left! And a moment later, I had caught sight of two similar meteors, one smaller than the other, rushing toward us in the same direction from ahead. But these I had seen soon enough to avoid collision.

It was evident that, as Whitely had suggested, we were encountering some of the stray meteors that might be expected to whirl here far out from the meteor-swarms of the great rings. And as we watched tensely now for more meteors, it was with something of awe that we gazed toward the huge rings, that we knew to be rushing swarms of countless similar meteors. It was well, as Marlin had said, that we were not called upon to penetrate through or around those great rings, since in their awful whirling swarms of meteors no craft would be able to live even for a moment. But our space-flier was passing the midmost point of those rings; already huge Saturn was beginning to drop a little behind us; and we breathed more freely. And, ironically enough, it was at that very moment of our relief that catastrophe came upon us. There was a wild shout from Marlin, and simultaneously I saw a huge round dark mass looming dead ahead and whirling toward us. Just as I snapped open the control-levers, that great dark meteor's mass had struck our onrushing flier with a tremendous stunning shock!

For an instant, as the flier reeled and spun there crazily in the gulf of space, it seemed the end to me, but in a moment more I realized that the great faceted walls had not been penetrated, for the air in the flier was unchanged. Had those walls been pierced, the result would have been the instant freezing to death of all of us. But that death had not as yet come upon us, and as I struggled forward in my chair I saw that the space-flier was still whirling crazily around from the shock and that the throbbing of its great generators had ceased. Beside me Marlin and Whitely and Randall were coming back to realization of their surroundings after that colossal shock, Whitely bearing a nasty cut upon his temple. And as Marlin sprang to the flier's side-window, gazed obliquely from it, he uttered an exclamation.

"That meteor just grazed us!" he exclaimed. "If you hadn't jerked the controls over at the last moment, Hunt, it would have hit us head on! As it is, it smashed through the flier's outer wall, but didn't pierce the inner wall!"

"But the generators!" cried Whitely, who had been fumbling at their switches. "They've stopped! When the meteor crashed through the outer wall it must have broken some of our generator-connections between the two walls!"

"And the flier's falling!" I cried in turn. "It's falling toward Saturn now, with its force-rays dead—*we're falling into the great rings!*"

For as I glanced outward I had seen that was what was happening. The halting of the generators by the breaking of their connections between the flier's double walls had halted also the force-rays that had been pushing us out toward Neptune and that had been holding us out from Saturn's pull. With the halting of those rays the pull of the mighty planet had at once gripped our space-flier and now we were moving at swiftly-accelerating speed toward that planet's mighty bulk, toward the great rings but a million miles to our left! Were falling helplessly, faster and faster each moment, toward those mighty rings, toward their vast swarms of whirling meteors in which our space-flier and all within it could meet only an annihilating death!

CHAPTER V

At the Solar System's Edge

"OUT of the flier!" Marlin cried to us. "Our one chance is to get out and repair those broken connections from the outside."

"But how——" Randall began, when the astronomer broke in on him. "The space-walkers! In them we can get outside, can try to repair those connections before we fall into the great rings!"

A moment we stared toward him in sheer surprise, and then as one we were leaping toward the four big space-walkers, suspended from the flier's wall. For though we had not dreamed, in taking them with us, of any such emergency as now confronted us, we saw that, even as Marlin had said, our one chance to escape the annihilation that soon would be ours otherwise lay in their use. Swiftly, therefore, we unhooked the great cylindrical space-walkers, neither they nor aught else in the flier having any but small weight now, that weight being the result of the pull of great Saturn, toward which we were falling. Quickly swinging open the section near the cylinder's base that was its door, therefore, I pulled myself up into the cylinder, then closed its hermetically-sealing door with the small inside lever provided for the purpose.

I was standing, therefore, in a metal cylinder seven feet in height and three in diameter, its top tapering into a rounded little dome in which were small windows from which I could look outward. My arms I had thrust into the great hollow jointed arms of metal that projected from the cylinder's sides, and had at my fingers' ends inside those arms the controls of the great pincer-hands in which those arms ended outside, and the control also of the small generator inside the cylinder whose little force-ray was shot down from the cylinder's bottom. This could be shot straight down, sending the space-walker upward by pushing against some larger body, or could be shot out obliquely sending the space-walker horizontally in any direction. Once inside the space-walker therefore, with its tiny generator throbbing and the equally small air-renovator and heater functioning, I was ready to venture out into the airless void.

Glancing out through the vision-windows I saw that Marlin and Whitely and Randall had struggled into their space-walkers also, and were signalling their readiness. We grasped therefore the tools and materials we had hastily assembled for our task, these being spare plates to repair the flier's outer wall and a small molecular-diffusion welder, and then with those in the grasp of our great pincer-hands were pulling ourselves toward the flier's screw-door. In a moment we had that open, and were crowding into the little vestibule-chamber which lay between the outer and inner doors. Closing the inner one tightly behind us, we swiftly screwed open the outer door. As it opened there was a rush of air from about us as the air of the little vestibule-chamber rushed out into the great airless void outside, and then Marlin was leading the way out of that door, out into sheer space, outside our falling space-flier!

I saw Marlin drawing himself in his space-walker through the door and then floating gently out that door, floating in space a few feet from our flier and falling at the same rate as it toward mighty Saturn! In a moment more I was following him. Whitely and Randall behind me, and as I too propelled myself with a slight push through the door, my cylindrical space-walker floated outward. I found myself, therefore, cased within that space-walker's cylinder, and floating in it in the sheer empty void of interplanetary space! Beside me was the great gleaming faceted ball of our flier, falling at the same rate as ourselves toward the huge rings of mighty Saturn, to the left. Beneath and before and on all other sides of me, though, was only space, the tremendous gulf, gleaming with the great hosts of stars on all sides, with the sun's brilliant little disk shining far behind us. For the moment our position was so strange, so utterly alien and unprecedented, as we four floated there beside the falling space-flier in our four great metal cylinders, that we could only gaze about us in sheer awe and wonder. Then Marlin, with one of the great metal jointed arms of his space-walker, motioned to us and toward the flier, and we realized that we had but little time left in which to accomplish the task now before us.

For with every moment the flier and our four space-walkers were falling at greater speed toward the colossal rings of huge Saturn, to the left, and the whirling titanic meteor-swarms of those rings were growing larger and larger. But a few hours remained before, with the growing acceleration of our free-falling flier, it would be meeting its end in those clashing, crashing meteors of the great swarm, so that if we were to repair the damage to it, and get its generators functioning again before it met its doom, we must work fast. Our four space-walkers were falling toward Saturn at the same rate as the great flier beside us, so that we hung just beside that flier in space without need to use the propelling force-rays of our four cylinders. And now Marlin, grasping with his great metal pincer hands one of the projecting joints of the flier's great faceted walls, was pulling himself around it even as he fell with it through space, was pulling himself around to its other side, where the meteor that had struck us a glancing blow had done its damage.

In a moment Whitely and Randall and I had followed, moving clumsily in our great cylinders as we fell with the flier on toward Saturn's rings, and as we reached the other side where Marlin was hovering now in his space-walker we saw that the meteor that had grazed us had demolished two of the great facets of the flier's outer wall, and had shattered and crumpled a third. Save for a slight denting, though, the inner wall seemed unharmed, a fact that alone had saved us, but the black cable-connections between the walls were broken in a half-score places, we saw. It was that severing of the connections that had halted our great generators, we knew, so now our first task was to repair those connections, and it was upon that task that we began at once to work. Surely never had men worked under stranger circumstances than those, was my thought as we began the work of re-matching the severed connections. For we four, cased in our four great cylindrical metal space-walkers, were falling through space at a tremendous and ever-increasing rate, even as we worked upon our great flier falling with us, we were falling through the mighty void toward the whirling rings of Saturn, looming immense in space beside us. It meant annihilation for us, if we could not complete our repairs in time to escape them!

And as we toiled there at the connections, it seemed to me that never could we complete them in time to escape the great rings. For not only were there a half-score

breaks in the intricate cables, but each cable held within itself a dozen smaller connections or strands that in each break must be exactly rematched. And working as we were with the great pincer-claws of the space-walker our progress was terribly slow. Minutes passed into an hour and another hour, as we labored furiously there outside the flier with those connections, and by then it seemed to us that the colossal rings of Saturn, a huge whirling storm of meteors, were but a few minutes from us, so vastly did they loom before us, and so swiftly were we and our flier falling. With the energy of utter despair we labored on there at the seemingly endless task of rejoining the intricate connections, our tools and materials that we were not using at the moment being simply released by us beside us, since they fell with us and our flier at the same rate toward Saturn and thus were within our grasp, our tools floated there beside us!

NOW we were approaching the last of the connections, but now too we saw that it was only a matter of minutes before our space-flier and we would be whirling into the edge of the mighty rings of Saturn, that loomed now gigantic in their spinning meteor-masses before us! Already meteors were driving about us in space more thickly, and only by a miracle had our helplessly-falling flier escaped them so far. It seemed impossible that we could complete our task before the flier and ourselves were shot into the crashing death of those colossal whirling meteor-swarms, but we were working with the mad energy of a forlorn hope, and now too Marlin was leaning toward us with his space-walker to shout something to us. For when one space-walker touched another, their two occupants could hear each other's shouts, the sound-vibrations carried through the touching metal sides. Marlin was crying to us that but minutes were left us, and was ordering Randall to return back inside the flier and stand ready there to shoot it away from the great-looming rings the instant that the connections were repaired!

In a moment Randall had obeyed, pulling himself around the falling flier to its door and inside, while Marlin and Whitely and I worked tensely upon the last of the connections, matching and joining them with the greatest speed of which we were capable. Now it seemed that greater meteors were all about us, and now the huger, denser masses of the mighty rings were towering vastly beside us, as at plummet-like speed our flier and ourselves whirled toward them and toward death! Hanging there in sheer space at the falling flier's side, working madly upon those last connections, with all about us the glittering hosts of the stars and with beside us the titanic bulk of great Saturn and its colossal rings, we seemed caught in some unreal and torturing nightmare. Then as the huge meteor-masses of the mighty rings loomed just beside us, as I reached with the pincer-hands of my space-walker toward the last of the connections, I heard from Marlin in the space-walker touching mine a hoarse cry of despair. But at that last moment my claw-hands were swiftly joining the last connection and in the next instant came the steady throbbing of the great generators inside the flier! In that instant we had grasped our tools with one metal arm and with the other each of us had gripped the edge of the flier's shattered outer wall. And then, just as the flier and ourselves seemed hurtling straight into the mighty wall of whirling meteors that was the great rings beside us, the space-flier, with us three hanging desperately to it, was hurtling away from those rings as its great force-ray shot from inside toward them, was flashing at terrific mounting speed out from them into space!

For an instant, so terrific was the accelerating speed of the flier beneath Randall's control inside, that we three, hanging to the broken outer wall in our space-walkers, seemed on the point of being torn away from our grip on it, of falling back to Saturn once more. But in a moment more, with a great distance already between the flier and the huge rings that had almost been our doom, Randall had halted it, was holding it motionless in space by means of a steady force-ray. Then we were swiftly repairing the break in its outer wall, by means of the plates and tools to which we had clung, setting those great plates in place to replace the three shattered ones, and then welding them swiftly into the flier's outer wall integrally by means of the molecular-diffusion instrument. That done we pulled ourselves around the flier's faceted surface to its outer door, opening that door and closing it again once inside the vestibule-chamber. Then as Marlin touched a stud the vestibule-chamber was filling with air, and in another moment we were inside the flier once more, were pulling ourselves out of the great space-walkers, with Randall already out of his and at the controls.

"That was almost our trip's end!" cried Marlin as he emerged from his space-walker. "Another few minutes and we'd have been inside the rings—would have been pounded into instant annihilation by the meteors there!"

I passed a hand over my brow. "Never again do I want to find myself in a situation like that," I said. "As it was, it was the space-walkers alone that saved us."

Marlin nodded, gazing out toward great Saturn looming gigantic still to our left. "If ever we come back," he said, "if ever we try to reach Saturn and explore it as we may some day, we'll have our work cut out for us. Those mighty meteor-masses—those rings——"

"Well, at present the farther we get from Saturn the better I'll feel," Whitely told us. "And I'm glad enough that there's no other planet between us and Neptune, at least, for Uranus is far way."

Now, recovering from the first shakiness of the reaction from our awful peril, we turned with Randall to the consideration of our position. Our great ray that had shot back from the flier, and had pushed us by its force out through the solar system, had been snapped out by the halting of the generators, and we had now only the side-ray that was holding us out from Saturn. I suggested, therefore, that for the remainder of our trip out to Neptune we turn the space-flier's rear force-ray upon Saturn instead of earth, since earth by now had dwindled to a small bluish-white star far behind. To train our rear force-ray upon earth and to adjust the mechanism that kept the ray trained automatically afterwards upon the object suggested, would take more time than if we were simply to push the rear force-ray against great Saturn.

Marlin approved the suggestion, so after sending the flier out farther from Saturn and ahead of it by oblique applications of the side-ray, we held it carefully in space until it was headed toward the far green spot of Neptune, and then turned on the rear force-ray with half its full power at the start. At once, with terrific acceleration, we were flashing on toward Neptune, the giant power of the

ray pushing against Saturn and driving our flier ever outward. So tremendous was that acceleration, indeed, that despite the shock-absorbing apparatus of our chairs we came near to being overcome by the awful pressure upon us. Yet it was necessary that we use the highest possible speed and acceleration, now, for our former speed and acceleration had been completely lost when the halting of the generators had allowed Saturn to pull us inward. And though we were now flashing out past Saturn's orbit, with only the orbit of Uranus between us and our goal of Neptune, we had still two-thirds of our journey before us! So colossal are the distances between the great outer planets, distances beside which the gaps between Mars and earth and Venus and Mercury seem tiny.

With the utmost acceleration of speed that we could stand, though, our space-flier was now hurtling outward, its great force-ray pushing against Saturn with more and more power and sending us flashing forward with greater and greater velocity. In the next dozen hours of our flight we had reached again to the speed of five million miles an hour that had been ours before we had met with our misadventure at Saturn. And as we hurtled on Neptune was slowly largening before our eyes, its distant, tiny little spot of calm green light becoming bigger, brighter, though very slowly. But the eyes of Marlin and Whitely and Randall and myself were always upon that green light-spot as we hurtled on, hour following hour and day following day in our eventless onward flight through the solar system's outer immensities of space. And still our speed was steadily growing until at last, by the time we approached Uranus' orbit, we were flying through the great void at the space-flier's utmost velocity, more than eight million miles an hour.

That was a speed colossal, yet so accustomed had we four become to the space-flier's tremendous velocities that it seemed not unusual to us. Flashing through the void as we were, the only objects by which one could measure speed were the planets before and behind us, and these changed in size so slowly as to make our speed seem small. The greatest change to us in the attaining of the space-flier's immense utmost speed was the change of conditions inside the flier itself. Formerly the pressure of our constant acceleration had replaced to some degree the effects of gravitation, that pressure forcing us always towards the flier's rear, as we turned more and more power into our giant pushing ray, as we shot out with greater and greater speed. But now, with our utmost speed attained and that acceleration's pressure missing, we floated inside the flier as though entirely weightless, being attracted only very slightly toward the walls by the slight gravitational attraction of the flier's mass itself. So that now the straps across chairs and bunks and the handholds here and there on the walls that we had provided proved indispensable to us, indeed.

IT was upon the fifteenth day after our start from earth, the first day of July as I noted by earth-reckoning, that we crossed the orbit of Uranus. As we approached that orbit, only our recording distance-dials, of course, marking the fact that we were nearing the path of Uranus, I stood or rather floated with Marlin and Whitely at the flier's rear windows, gazing backward. Behind us gleamed in the star-swept heavens the planets past which we had come, and those others beyond them. Great Saturn with his vast rings that had almost been our deaths was already dwindling fast, as our flier shot out from it with its force-ray pressing with ceaseless power against it. Already the huge ringed planet was but a tiny yellow disk of light to our eyes, so far out from it we were.

To the left, too, shone the white star of giant Jupiter, small but intensely brilliant still, while farther distant and infinitely fainter was the red spark that was Mars. Our eyes shifted from these to the bluish light-point that was earth, and then beyond it to the little disk of brilliant fire that was the sun, its light and heat reaching us now in the smallest of quantities as we fled on into the chill immensities of the outer reaches of the solar system. There close beside that fiery little sun-disk we could also make out the silvery little light-point that was Venus, and by making use of a small hand-glass could also discern closer even beside the sun the tiny point of rosy light that we knew to be Mercury, smallest and inmost of all the planets. But as we watched there, as our space-flier hurtled on at unvarying, colossal speed over the orbit of Uranus, it was toward Uranus itself we were gazing. Far back from us on the solar system's other side hung the green spot of light that was Uranus, booming onward in its vast path around the sun, but though we watched steadily through the hand glass toward it we were unable to make out the four small moons that accompany the great green planet, which shone with a deeper green even than the greenish spot of Neptune, ahead.

"Uranus—Venus—Mercury——," said Marlin, as he gazed musingly backward. "Those three we have not passed, yet they're no greater mysteries to us than those that we have passed. But some day——"

"Some day——," I repeated, staring back, lost in thought myself, not completing, any more than Marlin, the thought that I had started to express.

Nor did I need to complete it, for as Marlin and Whitely and I stared back to where the sun's disk sent its light bravely out across the unthinkable reaches of space that separated us from it, our thoughts were all on those three planets, on Uranus and Venus and Mercury, and on those others, Mars and Jupiter and Saturn, that we had passed. What wonders, unknown to us, might not exist upon any of those worlds? But they were wonders barred to us for the time, since time was the one thing of which we had the least, in our great rush outward to the sun's outermost planet, in our desperate race outward to attempt to save our own earth from the doom that hovered over it. For still that doom cast its shadowing wing darkly over earth, still Whitely's instruments informed us that the giant force-ray from Neptune was stabbing back toward the sun, turning the sun ever faster at the same remorseless rate. So that it was toward Neptune, after minutes, that we turned, taking our places in our chairs beside Randall, at the controls, and gazing with him toward the planet far ahead that was our goal.

And now that we had crossed the orbit of Uranus, some two-thirds of our colossal journey's length lay behind us, and Neptune was becoming ever brighter ahead, its pale green spot of light having become almost as brilliant to our eyes as Saturn, behind us. As we viewed it through our telescope, too, we could make out the tiny light-point of Triton, the single moon of Neptune. Somewhat larger than our own moon was Triton, we knew, and we could see through our glass what had long been known by earth's astronomers, that this single moon of Neptune's revolved about it in a plane sharply

slanted or inclined to the plane of Neptune's equator, to the general plane of the ecliptic or solar system. And close indeed seemed the light-point of this single moon to Neptune, since we knew that it was at almost the same distance from the great planet as our own moon is from earth.

It was toward Neptune and its little moon that our eyes turned now and in the hours and days that followed, while gradually our excitement became tense as the great planet loomed ahead of us. Soon it had become a perceptible pale green disk, widening out as we shot on and on toward it. We would reach it, we calculated, upon the twenty-first day of our journey, twenty-one days after starting from earth. An eternity it seemed, that period of three weeks, such vast realms of space we had come through, such tremendous perils we had dared and passed. But now all those perils and worlds we had passed, Mars and the deadly asteroidal belt, great Jupiter and Saturn and the doom that had almost been ours there, all these things faded from our minds as we found ourselves with our thoughts concentrated wholly upon the far planet that from the first had been our goal, that planet which we must reach if earth was to be saved. For ever, ever, the great force-ray of Neptune was turning the sun faster, and now less than a hundred days remained before that turning sun would be no longer able to hold together, would be dividing and releasing fiery doom upon earth and almost all its other planets.

What was awaiting us at Neptune? That was the question that was foremost in all our minds as we shot on in those last tense days. What manner of beings there would they be who, we had assumed, were stabbing this ray of doom toward the sun? What manner of beings *could* they be who could exist at all, if exist they did, upon such a planet as Neptune, a planet moving about the sun at the unthinkable distance of almost three billion miles? Upon a planet that could receive but a minute fraction only of the sun's light and heat compared to that received on earth? Upon a planet which astronomers had always believed to be of far lesser density than earth, of a density little more than that of liquids rather than of solids. Was it possible that upon this farthest of all the sun's circling worlds there could exist life of any kind, not to speak of life intelligent enough to stab across the solar system and spin the sun itself faster to its division and its universe's doom?

THOSE were the questions that throbbed through our brains now as our hurtling space-flier shot on and on, Neptune growing with each hour before us. By the nineteenth day its disk had expanded to such a degree that we were able to discern upon it the cloud-belts that had already long been seen upon it by earth's astronomers. By the twentieth those great vapor-belts were plainly perceptible, and also Triton, its moon, had become visible to our unaided eyes, revolving close about the great planet in its sharp-slanted plane, being now behind the planet but so much above it as to be completely visible to us. By the twentieth, too, the sun behind us had become hardly more than a super-brilliant star, its tiny fiery disk bathing us still with a certain amount of light, although long before this we had ceased to rely upon its heat on our flier's sunward side and had had recourse to our own heating-mechanism. By this time too, of all the planets, only Jupiter and Saturn were visible behind us; the rest were invisible to us at the colossal distances which now separated us from them.

It was not behind but ahead, though, that we were gazing, as our space-flier flashed over the last portion of its great trip, as Neptune apparently grew in size before us. Seated in my control-chair, with Whitely and Marlin and Randall in their chairs beside me, I watched the mighty planet fascinated, as we hurtled on toward it in the early hours of the twenty-first day, that day that we had calculated would bring us to our goal. And truly, now, Neptune was looming in something of its true greatness before us. Only a tiny point of light in a telescope on earth, hardly more than that on the long days of our journey outward, we saw it now in some size and splendor, a huge cloud-belted world as large almost exactly as Uranus, outrivaled in the solar system only by it and by the two giants of Jupiter and Saturn. Over sixty times larger than our own earth it was, a huge world spinning far out here at the solar system's very edge, the last outpost of that solar system with beyond it only the awful emptiness of interstellar space.

Silently we gazed toward its great, green disk, its small gleaming moon, as our space-flier throbbed on toward it. Whitely, as usual, was checking from time to time the performance of the never-ceasing generators whose great force-ray, pressing against Saturn still, was hurling us forward. Randall was gazing forward with me, helping me now and then to ascertain from our speed and distance dials our distance from the great planet. Marlin had applied himself to the telescope, was gazing ahead through it toward the big world's cloud-wreathed surface, touching a focusing wheel now and then. For minutes we throbbed on thus, the beat of the generators the only sound in the hurtling space-flier's interior, but at last Marlin drew back from the telescope's eyepiece and frowned as he gazed toward the great green planet ahead.

"I can make out nothing through those cloud-belts," he said. "Those belts show, as astronomers have always believed, that Neptune has a great atmosphere. But what lies beneath them we'll not know until we penetrate through them to the planet's surface."

"That won't be long," I told him. "We're already only fifty million miles from Neptune—should reach it in seven or eight hours more."

"You'll be slowing the flier's speed before long then?" asked Whitely, and I nodded.

"We'll wait until we're ten million miles from it and then cut out our rear-ray that's pushing us on, and send out a front force-ray toward Neptune to break our progress."

Those next several hours, however, seemed to us in passing to be drawn out to infinite length, so great had become our suspense. At last, however, as we stared tensely ahead, Randall gave the word beside me that marked our place as within ten million miles of the great planet, which had now grown to a vast pale-green cloudy disk in the heavens before us. And as he gave that word I snapped shut one of the six switches before me, turning off the great rear force-ray of the flier, and at the same moment snapped open another switch that sent a great force-ray stabbing straight out from the ray-opening in the flier's front, stabbing

straight out toward the great disk of Neptune ahead!

Almost at once our mad flight toward that huge world began to diminish in speed. Minute by minute the figures on the speed-dial crept backward, so that from eight million miles an hour our speed dropped quickly to six million, and then to four and to three and to two million.

With this swift decreasing of our speed we were experiencing now the reverse of that pressure that had been ours upon our acceleration, since now we were straining upward and forward against the straps of our chairs, the pneumatic shock-absorbing apparatus of those chairs functioning now as it had done then. But though we felt again the dizziness and slight nausea attendant upon these tremendous changes of speed, we forgot that in our intent contemplation of the huge world that loomed but a million miles ahead, its tremendous pale-green sphere, belted with great cloud-masses, seeming to fill the heavens before us. Already Marlin, with his instruments, had found as we neared Neptune that the giant world's rotatory speed was a little more than twenty earth-hours, solving a problem that long had defied earth's astronomers by the discovery that the great planet turned on its axis each score of hours.

An involuntary thrill of pride ran through me even as we shot in toward those great cloud-masses that encircled Neptune. Neptune! The sun's farthest world, and we four had reached it, had shot across the awful gulf that none had ever thought to span! Marlin, beside me, was gazing forward into the great cloud-layers now with the astronomical curiosity of all his career gleaming in his gray eyes, as we approached this farthest of our solar system's worlds. Whitely was contemplating it with his usual cool detachment, but thoughtfully. Randall's face was as eager with interest as my own must have been, and when, a little later, there came a low mounting roar of sound around our flashing space-flier, the roar of an atmosphere through which we were rushing, he uttered a low exclamation, swiftly manipulated our outside air-tester, and then turned to us.

"An atmosphere to Neptune, surely enough!" he exclaimed. "About twice the pressure of earth's, even this far out, and the air-tester shows a large percentage of water-vapor and rather larger amount of oxygen. Otherwise it seems much the same as earth's."

Marlin nodded. "We should be able to move in that," he said, "but the greater gravitation of Neptune will probably be such as to make it necessary to keep inside the space-walkers."

But now the space-flier was hurtling into the outer vapor-layers, that swirled about us in white mist-masses in the pale light that came to us from the tiny, distant sun. Onward and downward through those vapor-layers, through the cloud-belts about the great planet, our space-flier shot, while we four gazed ahead and downward, now with excitement keyed to an utter tenseness. Then with sudden stunning surprise, for we had thought those cloud-layers of immense thickness, our space-flier shot out and down from them, shot down into clear air, clear atmosphere. And as it did so, from the four of us came simultaneous cries. For there in the pale, dim unearthly light there stretched far away beneath us the surface of the planet that for so long had been our goal on our great race to save earth from doom, the surface of great Neptune!

CHAPTER VI

Into Neptune's Mysteries

"METAL, over all Neptune's surface!"

"A metal-covered world!"

Our stunned, astounded exclamation sounded together there as we gazed downward from our flier, whose drop I had instinctively halted. For it was metal indeed that lay beneath us, a gigantic surface of smooth dark metal or metallic substance that glinted dully in the pale light that fell on it, and that stretched away in all directions to the horizons, completely covering the giant planet Neptune as far as we could see! A metal-covered world! In amazement, in awe, we stared down upon it in that moment. For we had expected many things, many aspects which the surface of Neptune might have had, frozen ice-fields or flaming craters or even a liquid world, but never had we expected what we now saw beneath us. Never had we expected to find the huge planet thus sheathed in a dark metal covering that apparently extended over all its gigantic surface! And in all its vast smooth expanse, we saw, there was no higher structure of any sort, nothing but the level plain of smooth dark metal, sweeping far away to the flat horizons.

"Neptune a metal-covered world! And I think I see why, now," said Marlin quickly as we gazed down. "I think that I can understand why the beings of Neptune have covered their world with this shield——"

"But what lies beneath it?" Randall asked. "Do you mean that these beings of Neptune——"

"I mean that beneath this great shield they have built must lie the real world of the beings of Neptune—must lie the source of the giant force-ray that they're stabbing toward the sun!"

"But how to get down inside?" said Whitely. "There seems no opening in this gigantic metal shield——"

"We must go on, then," Marlin told us. "Must go on until we find some way of getting beneath, since beneath that shield there lies our goal!"

A moment we stared toward each other, and then I had snapped open one of the switches before me, turning the ray-direction dial, sending down slantwise toward the metal surface a force-ray, instead of the vertical ray that had upheld our flier. The pressure of this slanting ray at once sent our ball-like space-flier moving forward across Neptune's surface, across the smooth vast dark metal plain whose presence was so astounding to us. I glanced at the outside-temperature dial as we shot forward, saw that the atmosphere through which we moved though dense was cold indeed, hardly above zero in temperature. Then with Marlin and Whitely and Randall I turned my attention to the smooth great metal surface over which we were driving. On and on we shot, though, without finding any slightest change or opening or structure in that unending, dark metal surface, that swept away in its vast, bare curve to the horizons, which were very far from us, so great was the radius of curvature of Neptune's mighty sphere. But after tense moments of this fruitless watch from our racing flier, Whitely uttered a low exclamation and pointed ahead, toward a round lighter circle in the dark metal plain far to the left, a circular opening in the giant metal shield!

None other of us spoke as we gazed toward that

opening, but at once I had sent the space-flier rushing toward it. As we raced nearer to it we saw that that opening's circle was a full five hundred feet in diameter, and that we could see down through it a great, bright-lit space beneath! Tensely we watched, until in another moment I had sent the space-flier directly above the great opening, so that it hovered motionless above the circular opening's center. And as it hung there we four, forgetful for the moment of all else, were gazing down through the space-flier's window through that opening, down into the great more brightly-lit space that we could see beneath, beneath the huge metal shield that covered all this world!

The first thing that I noted, gazing downward, was that the space beneath the giant metal roof of Neptune was a great one, since it was a full mile from the opening in that roof to the surface of the world far below. Gazing down toward that surface, seeing at last the true surface of Neptune lying in the brighter light that existed in some strange way beneath the gigantic metal roof, we gasped. For upon that surface there loomed countless strange structures such as we had never seen before. Rectangular in shape were those structures, with straight black walls, of great size but seeming rather low in height, and they were without exception roofless! In them we could dimly make out from our great height the gleaming shapes of what seemed huge machines of one sort or another, but could not at that height see whether living beings of any sort moved among the structures. The great circle of the world beneath that we could see, hanging above the opening, was completely covered with these structures, the black walls of one roofless building being surrounded on all sides by the walls of others, there being no streets or open spaces whatever between them! It was as though, indeed, all the surface of the great world beneath had been divided into great compartments by a great checker-board arrangement of intersecting black walls!

Marlin's eyes were gleaming with excitement as he gazed down. "The city of the creatures of Neptune!" he breathed, as in awe we four stared down. "The city of Neptune that lies beneath the colossal roof, and that must hold somewhere that which we have come to seek!"

"You're going to venture down into this city—down under the great roof?" I asked, and he nodded.

"We must, Hunt, to find the giant force-ray's source. But stand ready to flash the space-flier back upward—for if we're discovered by whatever beings inhabit this strange world, I think we'll get short shrift!"

A moment we paused there, and then as my hands moved upon the switch-controls, decreasing the power of the force-ray that held us upward the space-flier was sinking smoothly and slowly downward, down through the great opening! Tensely and with fascinated interest we gazed about now as we sank into the great space that lay beneath the huge metal roof. That space was brighter-lit than above the roof, we saw, and as we turned a moment to glance upward we saw that looking upwards, the roof was perfectly transparent! Dark, opaque metal when seen from above, it was almost invisible in its transparency when seen from below! And, seeing that, we understood the great roof's purpose. It had been constructed and placed above all Neptune, encircling the great planet and enclosing it, to retain that planet's heat as much as possible. For it was apparent that heat and light radiations or vibrations could not pass up through the metal of the roof from beneath, making it appear black and perfectly opaque from above, but could pass freely down through it from above, making it appear almost perfectly transparent from below!

EVEN as we grasped the wonder of that, though, we had forgotten it, in the greater wonder of the things that lay now before our eyes. For as we sank down in our space-flier into the great space beneath that roof we could see the surface of great Neptune itself, stretching far away beneath that mighty enclosing shield above it, and covered to the horizons by the strange rectangular and roofless structures such as we had already seen. These were formed, indeed, by smooth black walls of some two hundred feet in height that ran in straight lines in checker-board arrangement across all the surface of this huge planet, apparently, forming upon all its surface, without streets or parks or openings of any kind, a vast city of rectangular compartments, large and small! A titanic streetless city that covered apparently all the surface of giant Neptune!

But most wonderful of all the things that lay before us in that moment was the fact that nowhere about us could we see any sign of supporting pillars or piers for the giant roof that stretched far above us! For though we could gaze far away to the distant horizons of this great world, we could find no single support for that huge metal roof that apparently covered all the great planet, and whose weight must have been incalculable! And another feature of the giant roof puzzled us. It puzzled us to see the great openings in it like that down which we had come, great circular openings which we could see in it here and there at great distances from each other. Those openings were provided on their under-side with great sliding shutters for closing them tightly, yet all were open! Why should they be open, we silently asked ourselves, if the purpose of the roof was to retain Neptune's heat within that roof? For the existence of those great and unclosed openings in the roof must surely be defeating that purpose, for our outside-temperature dial recorded the same zero temperature as prevailed above the roof!

Yet even these strange things could not wholly draw our interest and attention from the strange compartment-city beneath, as our space-flier sank toward it. We were within a few hundred feet of it, now, and as we dropped nearer, Marlin and Whitely and Randall staring eagerly down beside me, my hands were tense upon the switch-controls, ready to send our flier leaping instantly upward. For if the beings of the city beneath, whatever their nature, caught sight of us, we could expect nothing but instant attack. So that a tenseness held all of us as our great flier's faceted polyhedron dropped on through the pale light beneath the great roof toward the black-walled, checker-board like city that stretched across the surface of the great world beneath us. And now, as we sank lower, our eyes were making out ever more clearly the details of that amazing city.

The rectangular black-walled compartments held, as we had half-realized from above, various strange-shaped mechanisms and objects which we could even now only vaguely discern. We could see clearly, though, that here and there across all the vast city's compartmented surface there stood giant metal globes, each a hundred feet in diameter and each occupying a square compartment of its own. There seemed hundreds of these great

gleaming globes, scattered here and there in compartments across the city's surface as far as we could see, though their purpose was then quite incomprehensible to us. But as we sank lower still, ever more cautiously, it was not the globes or the compartments' contents that held our attention so much as the astounding, stupefying fact that now was thrust upon us—namely that in all the gigantic compartmented city, in all its strange great black-walled rectangular and roofless enclosures, *there moved no living being!*

"Dead!" Randall's cry expressed in that instant the stupefaction of all of us. "A dead world!"

"Neptune—a dead world!"

A dead world! For truly it seemed a dead world that lay there in the dim pale light beneath us! A world whose strange contiguous compartments stretched away from horizon to horizon to form the colossal city above which we hovered, but a world, a city, in which was no single discernible thing of life! The endless black-walled compartments, the strange-shaped structures and mechanisms, the great enigmatic globes—all these things lay beneath us in a silence and a death that were stunning to our senses! Lay beneath us as though death had reached out of the unknown to annihilate suddenly all living things upon this alien world, leaving in it only the cold and the silence and the death that enwrapped it now! Neptune—we had flown across the awful void toward it for week upon week, prepared to find within it any strange beings, any alien and terrible form of life, but never had we been prepared to find it without any life whatever—an utterly lifeless world!

As we stared down toward it in utter silence it seemed to me that my brain was spinning from the stupefying shock of amazement that was ours. For if the world beneath us was truly a dead one, if Neptune lay now without life, its colossal compartment-city entirely lifeless, whence came that giant force-ray that was stabbing across the solar system from Neptune to turn the sun ever faster toward its division? Whence came that doom which was being loosed upon our earth and upon all the solar system, almost, by that gigantic ray? Was that great ray, after all, only some incomprehensible freak of natural forces, impossible to withstand, and had Neptune, once the home of some alien, mighty civilization, lain for eons in silence and death? Had our desperate mission which alone held a chance for earth, our terrific race out through the unthinkable reaches of the solar system's spaces toward its outermost planet, been in vain?

Marlin must have felt something of the same despair in that moment, but his strong face betrayed no trace of it as he turned to us. "It's evident that his vast compartment-city, this whole world, perhaps, is deserted," he said. "But where does the great ray come from?"

Whitely shook his head, glancing at his instruments. "Impossible to say," he said. "The recording-instruments here show only that we are close to the great ray's source, that that source is in the region around Neptune. But the emanations or reflections from it striking the instruments are so powerful as to make it impossible to determine the ray's source exactly."

"But the city beneath!" I cried. "Even if it is dead, deserted, we might be able to find in it some clue to what has happened here, some idea of what manner of creatures the Neptunians were, and perhaps some clue to the great ray's source!"

Marlin pondered, then nodded. "Hunt's right," he said. "If we explore this deserted compartment-city beneath we may find some suggestion that will lead us to the great ray's source. And we *must* find out soon, for only eighty-five days are left before the sun divides into a double star and dooms earth!"

"But we shouldn't risk all of us on this venture," I said. "The safest way would be to keep the space-flier, with two of us inside, hovering here above the city while the other two go down to it and explore it in their space-walkers."

This we finally agreed to do, and Marlin and I insisted upon being the two to make the venture, Whitely and Randall reluctantly agreeing at last to remain within the space-flier, watching and waiting for us. So, bringing the space-flier down to a height of a thousand feet above the compartmented city, I set the force-ray to hold it motionless there, Randall taking my place at its controls. Then Marlin and I were quickly getting into our two cylindrical space-walkers. Once inside them, we each gripped in a great pincer-hand the pointed bars of steel that we were to take with us, and then unscrewed the inner door and passed into the vestibule-chamber. Another moment and with the inner door closed, the outer one was swinging open, and the denser and colder air from without was rushing into the vestibule-chamber. We did not feel its cold, however, snug in the insulated and heated cylinders of the space-walkers, but drew ourselves to the outer door, turning on the force-rays from the bottoms of our cylinders. Then as we drew ourselves out through the door and into empty air, we were both sinking gently downward, our fall slowed to a mere floating drop by the down-pressing power of our force-rays.

DOWN through the dim pale light of Neptune's day we sank, down until just beneath us lay one of the intersecting black walls. As I saw this I shot my supporting force-ray outward at a slant, and as this sent me down obliquely, I floated down past that wall, Marlin doing the same beside me, and in another moment we had come gently to rest just above the black smooth floor of one of the great compartments, the force-rays from the bottoms of our space-walkers holding us a foot or so above the floor. Resting there, Marlin and I looked up first. Beside us towered the black two-hundred foot wall of the compartment, and far above we could make out the hovering space-flier, its great gleaming polyhedron hanging motionless and watchful above. We waved the great metal arms of our space-walkers toward it, toward Whitely and Randall inside it, and then turned to examine the place in which we stood.

It was an oblong compartment some four hundred feet in length, and half that in width, its great black walls towering on all sides of us. Ranged around the compartment against those walls were rows of strange squat mechanisms of a roughly pear-like form, that loomed each a score of feet in height. Marlin and I shot our space-walkers toward the nearest of these mechanisms, to examine it. We saw that in the top of it was an odd cone-like opening, and that there ran out of the gleaming metal cover of the thing a thick pipe or tube that connected with a larger pipe that encircled the compartment, connected to each of the mechanisms. Then as we reached forward, swung aside the metal cover of the mechanism, exposing an intricate system of sections in-

side it through which ran slender tubes acted upon by what seemed projectors of electro-magnetic force about them, Marlin pointed toward them, leaned toward me until his space-walker touched mine and spoke to me through the touching metal.

"A water-making mechanism this seems to be, Hunt," he said. "In some way it must draw down ceaseless supplies of hydrogen and oxygen atoms from the great vapor-masses above the roof, and then recombine them here into water."

I nodded, gazing at the thing. "But it hasn't been used for years—for centuries, perhaps," I said. "Look—that dust upon it——"

For upon the pear-shaped mechanism before us, and on all those others and all other things about us, there rested a coating of fine dust that was inches thick, a dust-coating that we knew only a great period of time could have deposited there. A moment we stared at that, two grotesque figures there in the great cylinders of our space-walkers, and then were moving on, along the wall. That black smooth wall, we saw now, was composed of a material that looked much like a black seamless stone, but one that seemed diamond-hard. For our pointed steel bars could make not the slightest impression upon it, and it was evident, from the monolithic construction of the great walls about us and of the smooth black paving upon which we walked, that this diamond-like smooth stone had been artificially made. Later we were to learn that it was constructed by a building up of molecules into a deliberate crystalline formation that far exceeded the strength and stability of any other material's crystalline structure, and thus gave to the black artificial stone a diamond-like hardness and a tensile strength exceeding that of steel.

Around the great compartment we walked, our eyes ranging over the great pear-shaped mechanisms and the great pipes connecting them, and then Marlin and I stopped short. For there in the black wall before us was a door, an opening that connected with the adjoining compartment on that side. It was by means of doors like that, it was plain, that the necessity of streets in this compartment-city had been obviated, making it possible to pass across the city through the compartments themselves if needed. Yet it was in stupefying surprise that Marlin and I now gazed toward that door. For it was all of six feet in width, but hardly more than four feet in height! Its opening stretched there in the black wall as though an ordinary door-opening of one of earth's buildings had been set in that wall sidewise! And as we looked stunnedly about we saw that all the doors set in the compartment's four walls were of the same size and shape!

"Those doors!" I cried to Marlin, leaning beside me. "Those were never made for human beings or for near-human beings!"

"Then these Neptunians that once were here—" Marlin began, and then stopped; we gazed in silence at each other through the vision-windows of our space-walkers.

And silence seemed oppressive all about us then, a silence that lay as thickly over the deserted compartment-city as the thick dust of unguessable years that covered it. A chill seemed to have struck home to us in some strange fashion with the discovery of those grotesque door-openings and their significance. I glanced upward, saw that the faceted ball of the space-flier was still hanging motionless high above, and then as I turned back saw that Marlin had moved toward the low door toward which we had been gazing. A moment he contemplated it, then motioned to me with the big metal arm of his space-walker, and as I came to his side, grasped that door's edge with his great arms and lowered his space-walker's big cylinder until it lay on its side on the smooth black paving. Then he was drawing it through the door, aiding himself with a force-ray shot from the opening in its bottom toward the compartment's opposite wall behind us. When he was through, he drew himself erect, and in a moment I had followed him and was standing with him in the next compartment.

That second compartment, we found, was a replica of the first, being of the same size and holding within it several dozen more of the pear-shaped water-manufacturing mechanisms. We passed through it, therefore, over the dust-strewn paving and through the low similar door on its opposite side, to find ourselves in still another compartment of water-manufacturers. Pressing on, rapidly becoming able to pass through the low strange doors easily in our cumbrous space-walkers, we passed through a half-score more of similar compartments all holding only the dust-covered, pear-shaped water-mechanisms, and then at last we passed into a different compartment, one that held a strange shelving that covered all its walls, at which we stared in perplexity for some time.

This shelving consisted of horizontal and perpendicular shelves of smooth black stone like that of the walls themselves, running along and up and down those walls and forming thus a continuous series of box-like openings, each some four feet in length and two in height. There were hundreds of these shelves in the compartment, we could see, yet all of them were quite empty, and in the compartment there seemed to be no other object. They suggested the equipment of a store-room, yet there was no faintest clue as to what had been stored in those shelf-tiers of openings, ranged one above the other all around the walls. Had Marlin and I been able to guess the astounding truth as to those tiers of compartments as to their significance and purpose, much would have been clear to us right then. As it was, after vainly endeavoring to fathom the purpose of the things, we gave it up and moved on out of the compartment, and through similar shelf-tiered compartments beyond it.

BY this time we had passed some distance from beneath our hovering space-flier, but still could see its gleaming polyhedron hanging high in the air behind us. Reassured by the sight of it, we passed on, and in the next half-hour progressed through many more compartments. Some of these contained water-manufacturing mechanisms or tiers of strange shelf-openings such as we had already seen. But many others held mechanisms or objects strange to our eyes, before which Marlin and I stood entranced. We almost forgot, in the overpowering interest of the things that we found in those compartments, the object of our exploring search through the strange compartment-city, our search for clues as to the beings of Neptune and as to the great force-ray that was turning the sun ever faster.

Compartments we found in which were structures that puzzled us as completely as had the tiers of shelf openings. These structures were great flat metal containers, each scores of feet in length and width but hardly more than a foot or two in depth. They were

ranged one above the other in great supporting frameworks, and each container was filled with black fine soil. The compartments that held these had set in their walls great white disks which were connected to intricate apparatus that seemed generators of some kind of force, but more than that we could not ascertain from our inspection of them. The whole arrangement, the great shallow containers of soil, the disks in the walls, the generators connected to them—all was utterly enigmatic and perplexing to us, and we were forced to give up the riddles and pass on into other compartments, in which were other things almost as mysterious.

Some held giant globes of burnished metal, now dust-covered, which occupied almost a whole compartment each. These great gleaming globes were among the most puzzling things we had found, since there was, in the compartment of each one, no other object or indication of their purpose, save for a few switches mounted upon a panel, the combination of which we could not discover, opening and closing them in vain. We had seen these great globes from above, dotting the vast compartment-city here and there in great numbers, but we could learn no more of their purpose standing there beside them than we had been able to guess from above. And near these there were strange looming machines, many-cogged and with a great hopper above whose purpose we guessed, at least, guessing that these were the mechanisms that produced from some raw materials the artificial diamond-hard black stone-material that made up all the intersecting walls of this strange huge city-world.

Each of these machines had before it a very low, round metal seat, with in front of that seat the controls of the machine, a half-dozen burnished metal levers. As we saw them Marlin and I exchanged startled glances. Had the being who operated that machine, who sat before it, held and operated *all* those control-levers of the mechanism? Back to our minds flashed the strange low openings of the doors through which we had come, and for a moment the same strange sense of dread chilled me. But I shook off the feeling, followed Marlin on into another compartment, glancing back through to where our space-flier poised in the air now far across the city behind us.

It was into another long rectangular compartment that we passed, one that held, like that out of which we had just come, rows of strange many-cogged mechanisms. But one feature of that compartment caught our attention instantly, held us motionless and staring. And that was that those rows of great mechanisms were not complete! Here and there in those rows were gaps, as though machines had been removed from the compartment, and where those gaps were, where the missing machines had stood, were squares on the floor where their bases had rested, *squares that were entirely free of the inch-thick dust that lay over all else!* And even as we stared, as we comprehended the astounding significance of that, we saw that upon the dust-coated floor before us were many tracks, small round and strange tracks in the thick dust that were of great number and that had been made, it was apparent from their dust-free condition, but days or hours before!

"Marlin!" I whispered, grasping my companion's space-walker with the great metal arm of my own and touching head casing to head casing. "Marlin—those tracks—someone, something has been here—and but recently!"

"It can't be!" he exclaimed, his voice hushed strangely like my own. "Neptune—all this great compartment-city—it's all dead, deserted——"

"But those tracks!" I insisted. "Those squares in the dust—something's been here and has taken a half-dozen of these great machines away with them! And we know that something on Neptune is sending the great force-ray out to the sun!"

"It can't be," Marlin repeated. "We found no source of the great ray on Neptune's sunward side, and, too, how can that ray shoot always toward the sun from some spot on Neptune when Neptune itself is constantly turning? No, Hunt, I think that this means—*but look up there!*"

As he cried out he was gazing suddenly upward, his space-walker's great arms pointing up, and at that horror-stricken cry, I glanced up to see a sight that froze me motionless there in astonishment. For there, high above us and above the great compartment-city, a dozen strange great shapes were dropping down through the air toward us, were dropping down through one of the openings in the great roof! Long great cylinders of gleaming metal those shapes seemed, dropping silently and smoothly down from the opening, toward the compartment-city, but even as we looked in amazement and terror up toward them, they had halted in mid-air, as though seeing the faceted ball of our hovering space-flier hanging above the city far behind us. Then the next instant all the dozen great cylinders were flashing with unbelievable speed toward our space-flier, a half-score narrow, pencil-like rays of pale, almost invisible light or force stabbing ahead of them toward the space-flier!

Marlin and I cried out in the same instant as those great cylinders whirled through the air toward the space-flier, and in that moment it seemed to us that our wild cries had been heard, for we saw the space-flier whirl itself to one side suddenly, as though Randall and Whitely in it had caught sight suddenly of that onrushing menace. The pale, almost unseen stabbing little rays of force or light shot past them as they swerved thus, and then the next moment cylinders and space-flier seemed to be whirling in a wild melange of geometrical metal forms there in the pale dim light above the great compartment-city. We saw the slender, pencil-like shafts of force stabbing this way and that, saw one cylinder, struck by the shafts of its fellows, riven asunder by those shafts as though by swords of steel and then suddenly the gleaming polyhedron of the space-flier had plunged up out of the wild mêlée and was rocketing up toward one of the great openings in the vast roof above!

As Whitely and Randall thus whirled the space-flier up in an effort to escape their outnumbering, unknown attackers, we saw three of the great cylinders rushing up after them. In another moment the space-flier, closely followed by its three pursuers, had rushed up through the opening and disappeared above, and as they did so we saw that the remaining eight cylinders were dropping now again toward the compartment-city! Watching stupefied still in our amazement, Marlin and I saw that four of the cylinders were heading down toward a point in the great city somewhat to the right of us, while the other four were slanting down now almost straight toward the compartment in which we stood! And as I saw that, as I saw and understood the significance of the tracks and missing mechanisms in this compartment,

I grasped Marlin's great metal arm with one of my own, again touching head-armors.

"They're coming down to this compartment!" I cried. "It was they who took the missing mechanisms from here—they've come for more!"

"Out of the compartment, then!" Marlin shouted. "They're after Whitely and Randall in the flier, and if they find us here——!"

With the words we were throwing ourselves, prisoned in our great cumbrous space-walkers as we were, toward the low door through which we had come. In a moment we were through that door, were in the adjoining compartment, but hardly had we gained it than there swept through the pale light from high above four great cylindrical shapes, slanting smoothly down toward the compartment we had just left! From above they could see us easily, whatever beings were inside those descending cylinders, so that as they shot down over our roofless great compartment, Marlin and I poised motionless, praying that our great gleaming space-walkers might be mistaken for mechanisms. Far across the compartment-city we could glimpse the four other cylinders dropping down toward a different point, also, and then in the next moment the four above us had shot down over us and with a throbbing sound coming clearly to us from those cylinders' interiors, were coming to rest in the compartment we had just left!

GLANCING for a moment at each other through the vision-windows of our space-walkers, Marlin and I then softly moved in them toward the low door through which we had just come. For though our fear was great, our curiosity, our realization of the mission that had brought us out here to Neptune, was greater. In a moment we were at the door, were lowering ourselves awkwardly and silently to a position from which we could gaze through it into the adjoining compartment. In that compartment, we saw now, the four great cylinders had landed, and were resting upon the floor at its center. Each cylinder was of forty feet diameter and twice that in height, and their gleaming metal sides were broken here and there by small windows. They were broken too, we saw with a start, by ray-openings like those of our own space-flier, and it was evident from those that the cylinders were propelled through space by the same force-rays that moved our flier!

Before we could fully comprehend the meaning of that fact, though, there came a low clanking of metal and before our eyes a section in each of the curving sides of the cylinders, near the base of each, was abruptly sliding aside, leaving in the metal wall of each cylinder a low oblong door-opening like those of the compartments about us. Now we heard from inside that opening a stir of movement, and saw vaguely a shape or shapes that moved in the cylinder's dark interior. Then, as we gazed with tense nerves toward that opening, there moved out of the cylinder's dark interior through that opening, into the pale dim light of the Neptunian day, a creature at which Marlin and I stared in that moment with horror-stunned minds! A being so grotesque and so awful in appearance that for the moment it seemed to me that it needs must be a creation only of our overstrained nerves and brains!

It was a creature that bore no conceivable resemblance to the human form or to any other in our knowledge. The body was a great flat disk of pale-green flesh, five feet in diameter and hardly a foot in thickness. It was supported in a flat or horizontal position above the ground by seven short thick limbs of muscle or flesh, which were each three feet in length and which projected down from the big disk-body at equal intervals around its circle. The only visible features of the creature were the eyes and mouth. The eyes were two in number, and were set close together in the *edge* of the disk body. They were like the eyes of some insect, being each inches across and bulging outward, being composed each of a myriad smaller glistening lens-divisions, like the eye of a fly! And as I saw with shuddering horror those two bulging strange eyes gazing about, it came to me that it was only by means of such great, powerful eyes and their many lenses that any creature here in the dim light of Neptune could see clearly all things about it!

The mouth was a white-lipped circular opening, and was set at the very center of the horizontal disk-body's upper surface! No stranger combination can be imagined than that which presented itself thus in the appearance of that creature before us, with the two bulging glassy eyes staring forth from the edge of the great disk-body, and the round mouth gaping there in that disk-body's flat upper surface. Slung around the disk-body the creature wore a flexible armor or dress of connected straps of flexible metal. In a loop of this rested a metal tube formed by the joining together of two tubes of dissimilar thickness. And attached to the flexible straps in another position, at the disk-body's edge, was one of the strangest features of its appearance, a small metal ball that seemed glowing with unceasing radiant light!

The creature gazed about him, unaware of our awe-stricken gaze, and then half-turned and seemed to call to others in the cylinder from which he had emerged, a strange sound issuing from his mouth-opening. That sound was like a swift succession of staccato snaps of sound, as clear and sharp as the snap of metal on metal. From the variation in their utterance, though they were in a single pitch only, it was evident that they formed the speech of the strange creature, and as he gave utterance to them, others like him, other similar disk-bodied green beings, were emerging from the cylinder behind him and from the other cylinders. In a moment a score or more were gathered there, moving toward the great cogged mechanisms beside them, and as they did so the staccato snapping of their strange speech came loud to our ears. And as they did so, too, we saw that the seven strange limbs of each of them served him as arms as well as supporting legs, since some used some of those limbs to carry tools, holding them tightly in fingerless, muscled grasp!

"Neptunians!" whispered Marlin beside me. "Neptunians, Hunt—those squat, flat disk-bodies—those great eyes——!"

Neptunians! Yet I had seen myself that they must be so, that only on a great planet like Neptune, with far greater gravitational power than earth, could those squat, flat bodies have evolved. For the greater the power of a planet's gravitation, the lower and the more squat will be the forms of life that evolve upon it. And just as these Neptunians had evolved in their strange disk-form here on the great planet, due to its greater gravitational power, so had their great light-gathering eyes been evolved by the dimness that reigned here always. And it was these beings, it was clear, who had built the vast compartment-city that covered all of the great planet's surface about

us, since it was only beings like these who would have built such strange, low doors in it for their own flat disk-bodies, only such beings as these who, with their seven great limbs, could manipulate the controls of the mechanisms we had seen!

"Neptunians!" I whispered it, myself. "But if it's beings like these who inhabit Neptune, who have sent the great force-ray stabbing toward the sun to divide it, where are they all? Why have they left all this city, all this world, dead and deserted?"

Marlin, inside his space-walker, shook his head. "God knows, Hunt! If all these Neptunians have deserted their world, where have they gone? I know no more than you. But it's clear that they've come back for more of those great mechanisms."

It was, indeed, evident that that was the object of the Neptunians' visit to the compartment-city, for now the score or more in the adjoining compartment were busily working with their tools upon three or four of the great cogged mechanisms that loomed there. Swiftly they were taking down those mechanisms, were dissembling them into a myriad intricate parts which were stowed away in the four great cylinders. More than once some of them passed close to the low door through which Marlin and I were gazing, but none ventured through it into the compartment in which we hid, seeming all to be intent upon the business at hand. And as they worked on we began to understand some of the features about them that had puzzled us in our first horror-stricken sight of them.

We had been puzzled, indeed, that they were able thus to move about unheedingly without protection of any sort in the zero-cold that reigned about us. But now as one or two of them passed close to the door by which we crouched, I gazed closely at the glowing little ball that each had attached to his metal armor, and guessed then what I was later to learn was the truth, that that ball was glowing with radiant heat and had the power of heating to comfortable temperature the atmosphere for a few feet directly around its wearer. Thus the wearer of it moved always in a little volume of warm air, though the air outside that area might be at zero temperature. And thus it was that the Neptunians were able to withstand the bitter cold about us, from which we were protected by our space-walkers.

As we gazed toward the Neptunians, they were completing the process of dissembling and stowing away the great mechanisms, and now I moved closer to Marlin, my thoughts being on retreat from the dangerous position in which we were. Not only might we be discovered at any moment by the Neptunians before us, but somewhere in the compartment-city behind us were others, we knew, who had landed in their four cylinders at another point. Whatever had happened to Whitely and Randall in the space-flier, Marlin and myself were in the most perilous of positions. Even were we to escape the Neptunians we could not exist for long in our space-walkers in this dead and deserted city, in the cold of this strange and terrible world of death. Yet to escape from them was our first consideration, and I whispered as much to Marlin through our touching space-walkers.

"We've got to get clear of these Neptunians," I whispered to him. "Back farther in the city we can hide until they go."

He was gazing toward the strange creatures and their tools and mechanisms with intense scientific interest, but turned toward me at my whisper. "We'll get back, then," he whispered. "It may be that Whitely and Randall——"

It was a sentence that he never finished. For we had hardly turned to cross the compartment in which we crouched than we had to stop short in our space-walkers. There behind us a dozen or more great disk-creatures had been standing—a dozen or more great Neptunians! Even as we faced them there in that stunned moment, their bulging glassy eyes upon us, I saw the tracks in the thick dust at our feet, realized that these creatures were of the others who had landed in the compartment-city, and that finding our space-walkers' tracks here and there in the thick dust, they had followed them, had trailed us and stolen behind us while we watched their fellows! Then in the next moment had come a staccato cry from the foremost of the Neptunians, and in the instant following they had flung themselves straight forward upon us!

For in this atmosphere sound penetrated our cylinders.

END OF PART I

Oh, Ye Fourth Dimension

Longitude and Latitude and Altitude, anon,

Now where in all perdition, has that Fourth Dimension gone?

Minkowski said he saw it in the fragments of a dream,

But ere he laid him down to sleep, where had that Russian been?

—A. S.

Something flashed in the sun above and ahead of me. I looked up and recognized it as one of the new silent electric planes gleaming silvery white

SYNTHETIC

By Charles Cloukey

Author of "Sub-Satellite," "Paradox," etc.

IT seems to us that in the not too distant future mechanical men, as we may call them, will pilot airplanes—albeit under the direct supervision of human pilots. There is no reason to doubt the efficiency of a robot in the matter of keeping to a specific course and thus leaving the supervising pilot free to carry on the odds and ends necessary in long-distance flying. When mechanical piloting has become an established fact, there is hardly any limit to the development possible in the field. This author, now well known to our readers, has incorporated some strikingly original ideas, not only in fast and furious airplaning, but on the subject of synthetic men, humanized, as well. "Synthetic" is not only a clever story of scientific interest, it is also extremely thought-provoking.

Illustrated by
MOREY

GRAHAM Greene and the Flaming Atom and I were sitting in comfortable wicker-chairs on the sunny porch of Graham's palatial summer residence at Atlantic City. An apparently endless beach and a blue-green ocean dotted with boats and hydroaircraft made up the view from the porch. The time was in the late summer or the very early fall of the year 2000, but I do not remember the exact date.

The young scientist's face held an expression curiously reminiscent of his father, Thornton Greene, who had disappeared from the world of men ten years previous, and of whom no trace had ever been found.

"Von," said Graham Greene to me, "Elmer Calvroon escaped from prison last week."

"How?"

"Attacked a warden to whom he had a superficial resemblance, knocked him cold before the poor fellow could call out, strangled him to keep him quiet, changed clothes with him and had the nerve to walk calmly out. The substitution was discovered in about ten minutes, but Calvroon had disappeared. It's the first successful jail-breaking in seven years. He has cold nerve, Calvroon. He made the change just before the warden was to go to his supper. The prison officials think a plane must have been waiting for him nearby. He's at large now."

Graham Greene was silent, and I knew he was remembering the events of the previous year, when Elmer Calvroon, who was his step-uncle, had tried to kill him. Before Thornton Greene had disappeared he had made a will giving the contents of a certain vault to Graham Greene, or in the case of the latter's death, to Calvroon. At the tenth anniversary of the disappearance of the elder Greene he was considered legally dead. The cold-blooded Calvroon, knowing that the vault contained the greatest scientific discovery of Thornton Greene, the secret of synthetic life, had attempted to kill Graham and obtain the secret, for Calvroon also was a scientist. His plan had failed and he had been imprisoned. Graham had inherited his father's fortune and the secret in the vault. With a trusted staff of truly great scientists he had taken possession of the voluminous notes, formulas, and instructions that the elder Greene had left, and was carrying on his father's work in secret. At this time the world in general did not know that Thornton Greene's secret was known to anyone. Graham was not yet ready to disclose the secret to the world.

"I am afraid," said Graham, "that he may make trouble for me. We shall have to take precautions. Elmer Calvroon might be exceptionally dangerous, particularly since he knows that I am now carrying out the identical plans and experiments he had so much wanted to work on. But let's change the subject. Von, you hold the world's record for the ten-mile straightaway airplane dash, don't you?"

"Yes, he does," said the Flaming Atom, "but he won't hold it long. He captured it last year in a Uaco speedster christened *Nemesis*. He made the ten miles in 59.016 seconds, which is at the rate of about 610 miles per hour. I was second in the American Aviation Company's racer, *Hokushu Katsu*, but my time was 1 minute 1.03 seconds. But you're going to lose your speed-crown this year, Vonnie. American Aviation has supplied me with a little stream lined beauty that is going to make United Aircraft Company's best efforts look sick."

"Time will tell, Flaming One. Uaco hasn't been asleep, either. Wait 'till you see the *Nemesis VI*."

"Six, Von der Konz? What happened to the *Nemeses II, III, IV*, and *V*? One year you fly *Nemesis*, and the next year *Nemesis VI!* What's the trouble?"

"The others," I said, "were either discarded or they crashed during the radio-control tests. You may be interested to know that *Nemesis V* made 652 miles per hour before she burst into flames!"

"She wasn't carrying a pilot, my friend. I won't have to make 652 to beat you next month when you fly the *Nemesis VI.*"

"What's the name of the boat American Aircraft has provided you with, Atom," I asked banteringly. "The *Hokushu Katsu IX*, or what?"

"The *Kanimura Fensu.*"

"I like those quaint old American names your company chooses for its American aircraft," I remarked, "but I hope they never decide to name a plane *Harikari.*"

"Wait a minute," said Graham Greene. "You two may be professional rivals, but theoretically at least you're personal friends. Let's change the subject again. Atom, my dear, are we, or are we not going to have Von der Konz here as the best man? Our wedding, you know, is scheduled for just after the races."

"Von der Konz shall be best man, Graham. After I've beaten him in the race I really must do something nice to the poor boy. You're coming to watch me beat him, aren't you?"

"I'll have many important experiments in progress," said Graham, "but I'll take time off, sweetheart. I couldn't miss it. It's much more important than artificial chromatin or synthetic cytoplasm. What colors will your plane be?"

"Gray and green. I was thinking of you when I chose them, Graham Greene."

"Very sentimental," I interrupted, "but you were wrong, Atom. How can you expect to win in a plane that doesn't go with your hair or your personality? You should have carmine to match that hair and crimson to match that temper. Who ever heard of a red-headed girl winning a race in a green plane, and with gray in addition? The color combination is atrocious."

"Your wit is a trifle heavy, Von. What colors are you flying?"

"Blood-red and gold."

"I hope you get second place."

"Thank you most kindly. I'm sure the sentiment is mutual. Here comes someone in a gray and green amphibian. That's not your *Kanimura,* is it?"

"Of course not." The Atom watched the flying boat's graceful swoop as it settled on the surface of the water. Suddenly she waved a slender arm. The pilot of the amphibian waved back to her. The Atom turned to Graham and me.

"That's Joey Vincennes. She's come to fly me up to Philly and watch the trial flight of the *Kanimura Fensu.* It's never been flown with a pilot before. The radio-controlled test flights gave results that are very promising, Vonnie. So promising that I know I'm going to beat you. Want to come with us and watch the test flight?"

"Not at all, Flaming One. I came down here to talk to your fiancé about some scientific matters. Go fly your potato-masher. I'm not worrying."

The Atom froze me with a look, kissed her future husband, favored me with another icy regard, and jumped off the porch. Her slender form, neatly encased in the khaki flying suit she was wearing, described a beautiful arc down to the beach almost twenty feet below. She didn't stumble as she hit the sand, and ran on out to meet her friend who had taxied the amphibian up to the shore.

A sigh escaped from Graham Greene. "What a girl," he said out loud. "I don't wish you any hard luck, Von, but I hope she trims you."

"Let's change the subject," said I. "How are your experiments coming along?"

His face suddenly grew very serious.

"Unbelievably well, my friend. I have seven of the greatest scientists of the whole world living here with me now. The entire second floor is perhaps the most magnificently equipped scientific laboratory in the world And we have accomplished the impossible. I haven't told the Atom much about it yet. We haven't told anyone yet. But I don't mind telling you, Von. We have produced synthetic life in that laboratory upstairs."

He rang for a servant and issued some instructions to him in a low voice. The man disappeared and returned several minutes later with a small portable cage containing a large healthy rabbit. Graham opened the cage and took out the bunny by his ears, and handed him to me.

"That rabbit was never born, Von. It has no ancestors. Atom by atom, molecule by molecule, we built up chemically from carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, calcium and other elements the five or six microscopic cells that finally developed into that rabbit. We made him from inorganic gases, liquids, and solids, and he lives."

"Wait a minute," I said, my head swimming. "Do you mean to tell me that life is a chemical reaction? Nothing more?"

"For many years it has been admitted that life is a form of energy. You have seen chemical reactions that have produced light or heat. And what are light and heat but forms of energy? A chemical reaction produces them. Why should not a suitable chemical reaction produce life, that other mysterious form of energy? It does. It has been doing so for ages. There was no life on this planet when it was part of a flaming nebula, thousands of degrees hot. Somewhere, sometime, that chemical reaction took place and life started the age-long upward climb through slow evolution. Yes, life is a chemical reaction, my friend, the most wonderful, the most glorious chemical reaction in the world."

"Wait another minute," I said, "My scientific knowledge does not begin to approach yours, but I cannot accept blindly all of your statements. No chemical reaction has ever produced energy, any more than a chemical reaction has produced matter. In some chemical reactions energy is liberated, but in others, you recall, external energy, such as heat, for instance, must be applied or the reaction will not take place. In many chemical reactions energy is absorbed, not liberated. And in no chemical reaction is energy *created* or *produced,* in the true meaning of the words. The existing energy is merely liberated by certain chemical reactions. If I am not right, I would appreciate being corrected."

"You are right, Von. I was extremely careless in the way I expressed myself. Let me say, then, that existing energy is liberated in the form of life when certain long series of almost infinitely complex chemical equations

are carried out under proper conditions of light, heat, cleanliness, pressure, and so forth; and that by carrying out such a series of equations in the laboratory, we eight men have duplicated protoplasm and other basic life tissues, we have solved the secret of chromatin, we have synthesized a perfectly normal rabbit, and we intend to carry our experiments much further."

Graham Greene paused a minute to let the full meaning of his words sink in.

"Some of my father's secret is missing, Von. His notes often refer to a microscope of some kind, without which he could not have made the discoveries that he did. This instrument must have possessed such power that he could see atoms within the molecules, perhaps even the electrons and protons within the atoms. In this way he could actually see and study a life-cell, atom by atom, molecule by molecule. And so he could find out what they contained and how they were put together. In this way he analyzed those complex organic substances in a way that left nothing to be desired. After analysis came synthesis, and my father worked out the most intricate chemical processes and equations in the world and put them on paper. We can duplicate his results, but we cannot perform the analysis without his lost instrument. We have no instructions for the creation of a dog; without his instrument, which is perhaps the greatest part of his discoveries, we could not discover the process that would lead to the making of a dog. But that does not say that a dog could not be artificially produced. A dog or, for that matter, a human being, consists only of a certain number of elements, put together in a complex manner. As a result we have life, and an imperfect organism that will support life for a period of time averaging somewhat less than a century. At death it decomposes into the simpler compounds and its elements.

"An unusual and unexpected phenomenon has come up during our work. After we had carried out several thousand separate operations and had put together the few cells that were to be this rabbit, we found we had nothing more to do! The rabbit developed to maturity in astonishingly short time. In three hours he was full grown, for we provided him with food enough. First we nourished him with injected carbohydrates made up of suitable organic compounds, then later we fed him in the usual way. He grew before our eyes. Metabolism proceeded at an unprecedented rate, a rate that I should never have believed possible if I had not seen it. The eight of us were astounded by the thing. In the three most exciting hours of my life that thing *grew* from a microscopic artificially manufactured egg to a full-grown rabbit. Then the hectic rush ceased. Since then he's been a perfectly normal rabbit, particularly well-behaved. . . .

"I do not pretend to explain that dizzying growth. Bronnsen, one of my associates, believes that those three hours were like half a lifetime to the rabbit. All things, even time, are relative. A day is many years to the fly that lives for that period only. All the first half of that rabbit's life was crowded into three hours, incredible as it seems. Oh, there's some reason for it, but we don't know what. When it reached maturity it stopped, it slowed down to a normal life. I wonder why. . . .

"We are dealing with unknown forces. As we do not possess that instrument of my father's we can only follow his instructions blindly. The accelerated growth is only one of the surprises that we have experienced.

"I know that you can be relied upon to keep a secret, Von. All of my father's voluminous notes contain only two processes. One is for the artificial manufacture of a rabbit. We have done that. The second is for the artificial manufacture of a man. We are doing that!"

"I think you are going too far, Graham," I replied. "Even admitting that you could duplicate the body of a man, would you not be entirely powerless to give him a soul? The soul is not an intricate compound of carbon hydrogen, nitrogen, and other elements; it is independent of the body. If you create a man, he will be a soulless, conscienceless, artificial product, not a human being. He might be very dangerous. It is always dangerous to meddle with the affairs of God and nature."

"Listen, Von. Let me show my side of the case. In the first place, you seem to be a victim of the popular and widespread idea that if man creates intelligence, that intelligence will destroy him, the superstitious and unkillable idea of Frankenstein, who created the famous monster. There is no logical justification for such a belief. Why should not a man, produced artificially in a laboratory, be in every respect as fine a man, mentally, morally, and physically, as any man naturally born? The latter product is nowhere near perfection even yet, after these few thousand years of humanity. I'm inclined to think that my laboratory specimen will be a *better* man than the average. He will not be handicapped by the inherited weaknesses and ancestral faults which influence the all of us, even the best of us. In the second place, again contrary to popular delusions, that thing we call soul, whatever it is, *is* dependent upon the body. If a man takes drugs habitually, not only his body will be wrecked, but very soon his entire character undergoes a change. Every outward manifestation of the soul is changed, and yet drugs are not spiritual, but actual physical objects, which do not act through the fourth dimension or in any other mysterious way to reach his soul. They affect the physical body upon which that soul, whatever it is, is dependent. In the third place, all 'spirit mediums,' to the contrary, we have not yet even one authentic, provable case of communication with a disembodied spirit, so we reach the conclusion that the body is a necessity to any soul to make itself known on earth.

"We do not know where the soul of a newborn child comes from, but it's there. It's there as a consequence of the body being there. We do not believe any child is born without a soul, do we? Nor do we know of any soul coming into being without a physical body. In all of our experience so far, we find that the former is dependent upon the latter, and we do not find any case of one without the other.

"I see no reason why my laboratory man should be an exception to the rule. I believe he will possess as much of a soul, or more, than you or I have. For four days we have been carrying on the process of manufacturing those vital cells that we expect to develop into a man, perhaps at that same breath-taking speed that the rabbit did. The speed of the metabolism is what astounds me. . . ."

The radiophone by Graham's elbow rang impatiently. Graham listened and turned to me with a look of horror.

"Von, Joey Vincennes crashed that amphibian just as they arrived at Philadelphia. Seemed to lose control just before she landed. She was unhurt, but the Flaming Atom's eyeballs are both destroyed in some way, and she is totally blind!"

His face was a study in love and despair.

"Von der Konz, here are the keys to my flying boat. Go get her and bring her to me quick, if you love a friend! She's at the American Aviation Company's test field. My plane is moored out there, to your left."

He took his heavy cane and walked into the house on his two artificial legs. He had been the victim of a crash once, himself.

I slammed the rabbit back in his cage and rushed out to the beach. Casting loose one of Graham's speedboats, I leaped in and was soon by the side of his hydroairplane. I am a racing pilot. I disregarded the regular air lanes, at the risk of being arrested, and made a straight line to Philadelphia. Graham's skyboat was not a racing crate, but it could do three hundred in a pinch, and I was crossing the Delaware River not much more than ten minutes later.

Something flashed in the sun above and ahead of me. I looked up and recognized it as one of the new silent electric planes, gleaming silvery white. It seemed to stall, put its nose down, and dive directly for me. Then the unknown pilot flattened out a scanty hundred feet above me and zipped over my head. I suddenly felt intense pain in my right wrist. My right ailerons jammed and none of the tail surfaces would work. I crashed on the American Aviation Company's field even before Joey Vincennes' wrecked plane had been removed. My crash didn't hurt Graham's amphibian much, except to wreck the undercarriage. I jumped out, determined to get medical attention for my wrist, which I found to be burnt as if someone had laid a red-hot bar of iron across it. I caught a glimpse of the almost invisible silvery plane darting away to the east.

Several men were running toward me, one carrying a doctor's satchel. He applied a thick dressing of some sort of salve and bandaged the wrist. Most of the pain was relieved. The next arrival was Garciac, the field superintendent, who ran up sputtering an irregular stream of poisonous profanity, some English, but most of it French.

"It is that white one, no? I see him flash by when Mam'selle Vincennes have the accident, and I am ver' suspicious, but I do not know, so I can do nothing! Now he flash by again and you fall, M'sieu'! You are hurt, no? He shot you down, yes? I have sent a radio description of that ever-damned white one to all the police. They will watch for him, is it not so? It are those United Aircraft devils. They blind our best racer for life so they will win the races. They are cowards, M'sieu'! And she is only a girl. They are pigs! They——"

I interrupted his torrent of words. "Wait a minute, Garciac. United Aircraft would like to have their plane win the coming races, because of the tremendous publicity and advertising value of such a victory. But they're not descending to any such dishonorable and murderous practices. Whoever it was that caused these crashes had nothing to do with United Aircraft, so get that out of your head! If Uaco is responsible for this affair, why would they attack me? I'm flying their boat next month, not yours."

Garciac looked at me in amazement, and noticed the scar on my left cheek. "Hermann von der Konz! You! What are you doing here?"

Before I could reply a radio operator had rushed up to the Frenchman and handed him a yellow slip of paper. His attitude changed. He told the operator to reply that the instructions would be carried out.

"It is from Graham Greene," he stated. Then he turned to the group of men who were standing around. "Prepare at once the ambulance plane for M'sieu' Von der Konz. Put the girl there. And call the police and get an escort of armed planes. Quick! We will take no chances with that white one!"

He bustled off to direct the preparations for the return flight. The doctor who had bandaged my wrist spoke for the first time.

"That white flyer has a devilish instrument, sir. It's like a pencil of intense heat. He flashed it across the wing of that other plane. The heat wasn't great enough to melt through the metal ring, but it melted through the control wires, which you notice are exposed on this type of plane, and put the plane out of control, so Miss Vincennes cracked up. The other girl, the one the newspapers call the Flaming Atom, must have glanced up at the white plane just in time to get that pencil of heat across her eyes. She'll never see again, sir. I just came from attending her as well as I could. She has been suffering great pain, but she doesn't want an anæsthetic.

"I had just finished bandaging her and was going to advise Garciac to call the police to investigate that white plane when you crashed here. That same thin beam of heat rays crossed your wrist, and a minute ago I was noticing where it had partially burned through your tail surfaces. I hope the police catch the flyer. He hasn't got more than one full minute's start, but there are many white planes in the sky at any hour of the day. He's got a good chance to escape, damn him!"

Two stretcher-bearers were gently placing the Atom on the cot in the Red Cross three-motored biplane. A spotless white bandage was over her eyes.

"Will you take me to him, Vonnie?" she asked.

"I am taking you to him, Elsie." (It was seldom that Graham or I used her real name.) "If anyone in the universe can give you back those eyes, he can."

She said nothing and leaned back against the cushions. I climbed into the cockpit. The escort of three police planes, armed with deadly guns and manned by expert gunners, had just arrived. We flew back to Atlantic City. There was no trace of the white plane.

She was soon in Graham's arms, on that high porch overlooking the wide beach and the ocean. Neither of them said anything. Words were superfluous. I was standing near them, I was slightly embarrassed and ill at ease, and my shadow fell across the Atom's face. She seemed to sense it somehow, held out her hand, and took a blind step toward me.

"Thank you, Vonnie," she said. "I—I guess I'm out of it. I hope you get first place."

She's game through and through, that girl.

A short, heavyset man rushed out of the house and puffed up to Graham. I recognized him as Bronnsen, one of the seven scientists who were helping my friend in his experiments. His excitement was so great that it was several moments before he could utter a coherent sentence.

"It has started, Greene. The man! The experiment has been a success! It grows before our eyes! Soon we shall have a synthetic man! What a triumph for science! You must come quick!" He took hold of Graham's sleeve and tried to pull him bodily toward the door leading to the interior. Graham shook him loose.

"Bronnsen, I can't come now. The seven of you will have to take care of that from now on. Or six of you, rather. Tell Arnold that I must see him. He must attend to this girl's eyes as well as he can, right now. If we take care of the underlying tissues immediately maybe —please God—we can give her new eyes."

Arnold, I knew, was a surgeon of exceptional ability and almost superhuman skill. Just what Graham's plan was in regard to the girl's eyes, I did not know, but whatever it was, he could have confidence in the kindly, patient and astoundingly skillful Arnold, who was not only a remarkably able surgeon but a remarkably fine man.

Bronnsen hurried back to notify Arnold. Graham Greene led the Atom into the house and had her lie down on a luxurious couch.

The radiophone on the porch again rang insistently. I was the nearest to it, so I answered the call.

"Is this the residence of Graham Greene?"

"It is."

"I want to speak to Hermann von der Konz."

"I am he."

"I am Smith, of United Aircraft. Your absence from New York has caused us much inconvenience in the last two days. The *Nemesis VI* is ready for the many final tests, and we have only twenty-nine days before the races. It is essential that you come immediately to New York and cooperate with our men, according to the terms of your contract. Your delay has set us back, and we will have to keep you busy from now until after the races. Come at once."

Smith hung up. I went to New York. I had to keep my contract. It was up to my company's rivals to get another pilot to take the place of the incomparable Flaming Atom. Many aspired to such honors, but very few could qualify. I knew that American Aviation had lost one of the most nervy and daring flyers in the world. Perhaps I should have been glad that my only dangerous rival could not take part in the race. But I was not glad, though the greater part of the United Aircraft people were. So I went to New York and for three hectic weeks and more buried myself in the mass of work there was to be done; detailed tests of every part of the little plane that was aspiring to break the present record by flashing over the ten-mile course in fifty seconds or less. It was I who was to pilot that man-made meteor, so I was sure not to let any detail escape me. The ten-mile straightaway dash is a gamble with death. I suppose I'm a fool to fly it every year. . . . .

Several times, in the evenings, I tried to call up Graham, but he had severed all connections with the outside world. I learned nothing of the success or failure of his experiments. He must have been a busy, weary man, for the strain of attending to the development of his artificial man, and his treatment of the Flaming Atom at one and the same time must have been very great. I could not blame him for not answering my calls.

Three days before the races the *Nemesis VI* was ready. I was advised to rest up, to relax. But my suspense and curiosity were too much for me. I went down to Atlantic City to see what had happened in that laboratory since I had left almost a month before.

Graham's servant ushered me into his living room. Arnold, the surgeon, was seated in an overstuffed chair, reading Shakespeare. He put down the book and smiled pleasantly.

"Hello," he said.

"Hello. I was expecting to see Graham Greene here."

"You cannot see Graham Greene now, Mr. Von der Konz."

"Why not?"

"He is asleep. The shock of the operation was very great. You do not know? We have just given him a pair of new legs, and that lovely girl of his two brand-new eyes. We are very proud of our success."

"You mean to say that you have restored her sight?"

"Yes. And his legs. That discovery of his father's will be a great boon to mankind. I doubt if I could clearly explain to you the process by which we have grown synthetic tissues in the place of those that were destroyed. It is marvelous——"

"Greetings, Vonnie!" the Flaming Atom called out to me.

"Well, well, Flaming One. You're a blue-eyed girl now!" I said, and it was true. Her eyes had previously been brown.

"Isn't it wonderful? Arnold here won't let me fly in the races this year though. He's awfully cautious. He says I'm too weak."

A tall blonde man with an exceptional physique entered the room carrying a letter. He handed it to the Flaming Atom. She read it and then overwhelmed him with congratulations. Arnold performed the introduction.

"This is Robert Nelson, the synthetic man," he said.

My mouth fell open from pure amazement. Nelson noticed it and smiled. He repeated my name. "Aren't you," he asked, "the man who tried to tell Graham Greene that I would not possess a soul?"

"I don't—I can't understand—you speak English!"

"Certainement. Mais aussi je parle le meilleur français!"

"Let me explain," broke in Arnold, as I hesitated, wondering if I were the victim of a practical joke. "One of the associates of Graham Greene, the gentleman with the name of Bronnsen, made a particularly careful study of all the circumstances connected with the abnormally fast development of that rabbit you saw, and reached the conclusion that its growth was only *relatively* fast, and otherwise quite normal. It was Bronnsen who saw that the synthetic man would grow at the same terrific rate until he reached full physical and mental maturity. So he provided, with exceptional foresight, for the education of Nelson by means of the hypnotic machines which are just now being adopted in the schools. Bronnsen also was careful to have these machines employed under the supervision of one of our best modern educators, and to have the machines speeded up to a rate corresponding to the abnormally fast growth. There were many other problems, such as feeding, exercise, and so on, which were also solved more or less satisfactorily. Bronnsen can tell you more about it than I can, for I have been devoting all of my time to the restoration of the girl's eyes and Greene's legs. But anyway, it took just nineteen days for Bob Nelson to reach adult manhood, and the growth stopped the same way that an electric light stops when you snap off the current. Bronnsen says he is very near to the secret of the rapid growth, but hasn't solved it yet. I hope he does. It fascinates me.

"But I assure you that Bob Nelson has a soul. You can see for yourself that he has a magnificent body, and you will take my word for it that he has a well-trained and intelligent mind. He speaks two languages and can

do trig, and calculus, not to mention the fact that he has become an excellent fancy diver, and if I guess right from the congrats he has just received from a formerly blind racing pilot, he has just qualified to fly the *Kanimura Fensu* the day after tomorrow!"

Bob Nelson smiled.

"He has," stated the Flaming Atom. "The same remarkable skill that made him an expert fancy diver in two hours has just enabled him to qualify for the races. I asked American Aviation Company to take him as my substitute, so they took him in preference to the other good pilots who had qualified. That's what you call pull, Von. I warn you, you're going to be flying against a superman."

Later that afternoon, after I had watched the synthetic man throw a heavy triplane around the atmosphere with the skill and nerve of an expert and experienced pilot, I reached the conclusion that truly I was not matched against a human flyer, but against an efficient scientific machine. I often wonder what my reaction would have been if I had seen into the future and learned what was to happen at the race.

He, who was called Bob Nelson, was not hindered by the age-old faults and inbred defects of humanity. He was perfection *plus*, a marvelous machine with a brain. An ordeal that would tire an athlete was nothing to that marvelous body of his. He learned difficult processes with incredible rapidity. I watched with wondering admiration that evening when he did a back triple flip from a thirty-foot diving platform and entered the water with hardly a splash.

"Von," I said ruefully to myself, "you can feel your speed title slipping." And it was so. My confidence was going rapidly.

Later that evening Arnold let me see Graham for a short while, though the operation had greatly weakened him, as the Atom's had weakened her. But my friend had a brand-new pair of legs, and he was supremely happy.

"You can see now," he said, "what a great benefit to humanity my father's process will be. And yet almost eleven years ago, when he announced that he could create living beings and living tissues in the laboratory, men persecuted him and practically drove him to disappear. I often wonder if he's really dead. Eleven years, without a word from him, the greatest scientist in the world. I shall never begin to approach his ability."

Still later that evening I became an unwilling eavesdropper at a conversation that filled me with a vague, shadowy misgiving, and the memory of which helped to account for the events that occurred at the race. After supper I had wandered into the parlor and had seated myself in the big overstuffed chair in the corner, and had idly picked up the Shakespeare that Arnold had been reading earlier in the day. Hardly had I seated myself when the Flaming Atom entered at the opposite end of the room at one side at precisely the same minute that Bob Nelson entered at the other side. The back of the big chair was toward them, and I was completely unnoticed. I didn't pay much attention to them until I heard their conversation. Then curiosity held me, though I knew that they thought they were alone and I could have left silently by a door near me. I doubt if my listening in was justified.

"Atom," said Bob imploringly, "can't you give me a little hope? You know I love you."

Her voice was very serious as she replied.

"I think you're foolish, Bob. I'm the only girl you're acquainted with, and you think you're in love with me. There are many things about the world you have still to learn. There are millions of other girls in the world, much more attractive than I am——"

"There couldn't be."

"—and if you knew a few of them you would soon get over your silly infatuation for me, Bob. You really haven't lived long enough to know what love is. I like you and admire you, but I loved Graham Greene before you were ever—created."

They were silent for a moment. When the boy replied there was a bitterness in his voice that hurt.

"I know. You couldn't love a—synthetic man. I'm just an imitation, a scientific experiment. Just a chemical reaction. I wish Graham Greene had never——"

"Please don't. You know it isn't that. You're not an 'imitation.' You're far better than most men could be. And I know that you have honor, Bob. I know you're a game sport. So I know that you'll realize that I'm engaged to a man I love, a man who has given me back my eyes. But I loved him long before that happened, and I'm going to keep on loving him. Realizing that, you'll see that you mustn't be making love to me. You'll get over this disappointment, Bob. You'll probably fall in and out of love several times, and there are lots of lovely unattached girls in the world."

When Nelson answered, the bitterness was gone, and its place was taken by something admirable.

"I beg your pardon, Flaming Atom. I'll never speak about the matter again."

"Thank you, Bob."

And Robert Nelson never did.

The next day Graham received a letter from his stepuncle, Elmer Calvroon. The letter was long, boastful, and threatening, characteristic of the man. Calvroon disclosed the details of his escape from prison, defied the police to discover his present hiding place, explained that he had altered his features and even his fingerprints until any positive identification would be impossible, and concluded his letter by revealing himself as the man who had been in the white plane that had caused the two crashes at Philadelphia.

A voluminous postscript gave many of the details of his device for projecting a long, narrow beam of intense heat, which he said he had invented while carrying on experiments with the rays above the heat-rays proper but below the infra-reds. Calvroon's pride in his accomplishment was in every word of his description of the thing. I had previously been acquainted with his boastfulness, so the letter was what I would expect from the man. It is hard to adequately describe Calvroon so that you can get some understanding of him. Perhaps his most dominant characteristics were a cold daring or nerve, selfishness, egotism, great scientific ability, especially along mechanical or electrical lines, and an almost blind determination to get what he wanted, no matter who opposed him. So it did not surprise me that Calvroon demanded that Graham turn over to him the secret of synthetic life immediately. It had been because of an unsuccessful attempt to kill Greene to obtain that same secret, that Calvroon had been imprisoned. This time, he stated, unless Graham gave it to him he would kill him with that heat ray.

We had already seen two examples of the effectiveness

of that beam of heat. At the Flaming Atom's suggestion, Graham showed the letter to the police and asked for protection. He got it at once. The police were particularly anxious to locate Calvroon because of his jail-breaking exploit, so that very afternoon a detachment of police arrived to act as Graham's bodyguard.

We never expected that Calvroon would make his attack on Graham Greene the next day at the races. But, after all, it was characteristic of his coolness and his determination that he would take the earliest opportunity to surprise his victim. He must have learned about the police guard and decided that Graham was not going to surrender that discovery of his father's, even under threat of death.

The morning of the races was clear and a trifle cold. There was hardly any wind at all. Most of us who had been staying at Graham's house went to the race-courses in south central New Jersey in a luxurious cabin monoplane piloted by the Atom's girl-friend, Joey Vincennes. Both the Flaming Atom and Graham Greene were present, the latter against the advice of Arnold. Bob Nelson and I were present, conversing pleasantly on the subject of plain and fancy diving, though neither of us was thinking as much about that, as we were about the ten-mile dash. Arnold was present to keep an eye on Greene, and Bronnsen was present to see the artificial man win the races. Because of the injury to the girl's eyes which had occupied all of Graham's attention, and the later operation on his own legs, it had been Bronnsen, much more than Graham Greene, who was responsible for the magnificent development of the synthetic man. Bronnsen was there to see the laboratory product prove his superiority over a natural man. Bronnsen informed me that I didn't have a chance.

Thousands of spectators had come by train, plane, and car, to see the races. Of course, traffic was jammed, accidents occurred and both the air and ground police had a hard time of it.

High above, with powerful binocular telescopes, we watched the various preliminaries; the 'chute-jump exhibitions, the fireworks display, the sham battle, the stunting exhibitions, the various longer races. The forenoon passed, each minute replete with thrills. Then the time approached for the ten mile dash.

The ten-mile dash is the most fascinating of the events, both to the spectator and to the contestant. It is in the ten-mile races that the supreme speed-records are made and broken. In a longer race, the pilot does not dare to use the ultimate maximum of speed and power in his plane, for neither the man nor the plane could stand up for any period of time longer than a minute and a half under the terrific acceleration necessary. At the six-hundred and more miles an hour, as you know, the course must be a mathematically straight line, for a pilot taking a corner even at three hundred goes unconscious for a few seconds, and a pilot taking a corner at four, five, or six hundred miles an hour, in ninety-nine cases out of a hundred, rapidly becomes a quite dead pilot. Either he doesn't recover his senses in time to keep his plane from crashing or else the turn is too much for his brain. In either case he's done for good.

Joey Vincennes landed the cabin-plane in the space reserved for contestants, and Bob and I got out and ran the gauntlet of television scouts, cameramen, sound-movie makers and snapshot hunters. Side by side were parked the gleaming little *Nemesis VI*, blood-red and burnished gold, and the *Kanimura Fensu*, in the milder tones of gray and green. These two were the only entrants, each representing one of the two great aircraft manufacturers. Trusted employees, expert mechanics, were seeing to the last minute detail of the tuning up of the planes. The radio announcer spoke into his microphone, informing all the world that the pilots of the two planes were, respectively, Hermann Von der Konz, holder of the present record, flying for United Aircraft, and Robert Nelson, an unknown pilot, flying in the place of the tremendously popular "Flaming Atom" for American Aviation Company. The announcer explained that the Flaming Atom had been put out of the race by an accident.

Of course, none of the thousands upon thousands of spectators, except that little group in the cabin plane, had the slightest idea that Bob Nelson was a "synthetic" man. The world was still in ignorance of the work of that group of seven scientists, who had followed the directions left by the missing Thornton Greene.

In spite of all that the police could do, betting was high, and literally millions of dollars, in the aggregate, were wagered on the outcome of the race. Each year that happens. The gambling instinct cannot be stamped out by law.

It will be impossible for me to describe that race in as short a time as it took to fly it.

There was a little delay at the start because of an accident to one of the six high-speed movie cameras that, taking exactly one thousand pictures a *second*, and perfectly synchronized, were used to record the time of the race, accurately to the thousandth of a second. Races have been won by as close a margin as three one thousandths of a second.

Bob Nelson had never before seen an airplane race, so he was ignorant of many of the customs and rules of the game. The officials assumed that he must have been cognizant of the rules, or he wouldn't be flying, so they failed to enlighten him.

Literally speaking it is not a race. Each plane flashes over the course separately, and then the records on the films are compared. The fastest (or in this particular instance, the faster) plane wins. This was the detail that the synthetic man didn't know. So when the starter fired his pistol, as a signal that I could start whenever I was ready (the plane parked to the left always starts first), Bob Nelson, thinking that we were both to fly against each other, instead of against time, started too. But I didn't notice him. I was too much occupied by the *Nemesis VI*.

Five miles are allowed to get up speed. That is, we had five miles to fly before flashing between the first two pylons that marked the real beginning of the race, and then the ten miles of the race itself to the finish line, marked by two other pylons. The time made in those preliminary five miles does not count in the score A pilot tries to cover them, not any faster than necessary, but to accelerate up to his absolute maximum speed just before reaching the start, and to keep that maximum until he has finished the ten miles.

In order to be sure that the course will be a straight line, control locks are used. As he passes the start the pilot pulls down a lever that locks the controlling surfaces of his plane immovable, as the pilot could not, at that terrific speed, keep his plane in a straight line unless he possessed superhuman strength. Besides, the control-

lock leaves the pilot's hands free to handle the throttle.

Crushed against the back of my glass-enclosed cockpit by the terrific acceleration, I noticed, just after I had reached my maximum, flashed between the pylons at the start, and jerked down the control lock, that close behind me was the gray-and-green *Kanimura Fensu,* AND IT WAS LOCKED ON A COURSE THAT GRADUALLY APPROACHED MY OWN.

The two planes, each at its maximum speed, were keeping even with each other, at least as far as could be determined by the naked eye. It took very few seconds, at better than six hundred and fifteen miles an hour, to see that the two planes were due for a crash, that their two courses were not parallel, but slanting towards each other. And still they kept even. If either could have increased its speed by fifty or sixty miles an hour, which was impossible, one could have passed in front of the other, and no wreck would have taken place. But they kept even.

In order to avoid the crash that would be the end of both planes and both flyers, one of us had to slow down, thereby losing the race.

It was a supreme battle of nerve, and it lasted less than forty-five seconds. When the *Kanimura Fensu* was actually within a hundred feet of me, and drawing steadily nearer every fraction of a second as the two little planes hurtled over their intersecting courses, I cut the throttle of the *Nemesis VI* to save my skin. I'm more important to myself than any race is.

But an airplane has no brakes like an auto, and deceleration is never quick. I perceived that I had waited whole seconds too long. Bob Nelson's plane was perceptibly gaining on me the second I surrendered, but it was so close to my side that I could see we would not clear each other.

I have had several close calls, and I am intensely interested in remembering and speculating about the rapidity and clearness of thought in times of danger. It seems as if time had slowed down. Each split second is clear, and action is instantaneous. Hardly three seconds after I had cut the throttle I had seen what was to be done, and by a combination of reflex and reasoning, had done the only thing that could have saved my life, for Bob Nelson had held steady on his course at his maximum speed, coolly taking a chance with death. He judged, correctly too, that I would concede the race to save my skin.

When I saw that further action was necessary, I jerked up the control lock, kicked the rudder bar violently to the left, and jerked back the control in order to send the plane up at a sharp angle, for I knew that I would lose consciousness as I swerved, and I figured that the higher I went the farther I would have to fall, the farther I fell the greater chance there was that I would come to in time to save myself. At three hundred miles an hour the unconsciousness is momentary. At a faster turn it is longer, and too great a speed on a curve will kill the pilot. In spite of my deceleration, which had hardly lasted three seconds when I made the curve, I was still traveling at more than five hundred miles an hour.

As the *Kanimura Fensu,* piloted by the synthetic man, flashed between the finish pylons to set a new world's speed record for man-carrying planes, the blood-red and gold rival, *Nemesis VI,* was reaching the top of its upward climb. It stalled, hesitated motionless for half a second, snapped back, and dove. It fell crazily.

I came to when it was close to the ground, landed it clumsily, and got out just in time to witness the incident that closes this story.

For the dramatic things happened then.

A white electric plane approached at great speed, high above the course. It flipped over on one wing, turned, dove, and passed over the cabin-plane where the other members of our party had been watching the race through the binocular telescopes, and as it passed, the beam of heat severed the control wires of the tail surfaces. The cabin plane started down in great jerks, as Joey Vincennes tried to maneuver it to the ground in spite of the useless tail.

I do not know what it was that caused Calvroon to pick that time for his revenge, but I think it was largely that theatrical love of the dramatic and daring that had manifested itself when he had previously tried to kill Graham Greene. And Calvroon's cold-blooded nerve, together with his conceit and that one-track mind of his, all combined to cause him to take this apparently foolish method of attacking.

But he had a good chance of succeeding. The police planes were all on the ground. If Calvroon got one minute's start with that silent electric skyship, the only thing that could catch him would be one of the racing planes, which of course had been stripped to the last superfluous ounce, and carried no arms. They would be an easy prey for that pencil of heat. I think Calvroon was perfectly aware that he would be hard to catch and harder to capture, or he would hardly have come so openly.

Revenge must have been a prominent motive. The previous attempt to kill Graham Greene had been a means to an end. This time the young scientist's death was an end in itself. Calvroon had always been emotionally repressed, and his hates were intense, whenever they came to the surface.

The white plane performed a clever time-saving variation on an Immelmann, and passed over the cabin plane a second time. This time the left wing partially crumpled.

I think Calvroon must have increased the power of his instrument since the episode at Philadelphia. The heat nearly severed the wing entirely.

The plane was still under control, of a kind, though it was side-slipping rapidly. Calvroon turned again to deliver the final blow.

I doubt if you realize the few seconds it took for the thing to happen. The populace were watching dazed. A few of the police had recovered from their surprise enough to run toward one of their armed planes and start to take off. They would have to act quickly, or the electric plane would be gone, probably to the east, out over the ocean, the direction in which it would have a very good chance of total escape. It had escaped that way once before. After all, Calvroon's action wasn't quite so foolish as it appeared at first moment.

The one who defeated Elmer Calvroon was the synthetic man. Recalling the conversation I had overheard in the laboratory, I think I can understand his motives, too. The Flaming Atom was on the cabin plane, and Bob Nelson made the sacrifice.

He was still in the air from the race, returning to the field from which he had taken off. He saw and understood immediately what was happening. Without one

(*Continued on page* 150)

Vis Scientiæ

By Miles J. Breuer, M.D.

"Once they feared us," said the Powers,
Sitting round in council grim,
They that ruled man's fearful hours,
Made him shrink from terrors dim;

"Now we serve them," said the Powers,
Owned up to it one by one;
"No more their reason from us cowers."
These are things that they have done:

They have chained the livid lightning that goes hurtling down the sky,
Made it slave for them and pass them scatheless as it hurtles by;
They have trapped the furious tempest at whose breath the forest reels,
And the angrier it rages all the merrier turn their wheels;
The ocean is their plaything; they have placed upon his back
Mighty palaces, nor swerves them all his lashing from their track;
The thundering of the cataracts, the swing of wave and tide
Must meekly light their dwellings, and must draw them when they ride;
E'en the sun, almighty monarch, whom the ages held in awe,
Now must yield and run their engines; even on his strength they draw.

O'er the stretching, lonesome plains,
League on league and waste on waste,
Creep and wind their humming trains,
On, in whirling, roaring haste.

'Cross those reaches, empty, vast,
O'er the boundless, fearful sea,
Speed their heralds, countless, fast,
Huge in throbbing majesty.

Where the dismal desert rolls,
Stopping not for rocks nor mires,
Those unbroken lines of poles
With their endless, stretching wires.

Scattered o'er the broad, green land,
Everywhere in spreading spots,
Towering, huge, their cities stand,
Stirring, pulsing, teeming clots.

Huge, swinging bulks,
Great, clumsy hulks
Move all about;
And in and out
Among them creep the tiny creatures whom these Titan things obey.

Away on high
Through the vast, free sky,
Those deeps so still
Forever thrill
With the silent things they're sending quivering on their unseen way.

All over the Earth is the work of their hands,
And under the Sea and the Ground;
With blossoms they've covered the desert's hot sands,
Made day out of night profound.

They're puny and feeble, these small, swarming men,
Mere motes in the while of their Fates;
But they work with each other, together, and then
All Nature their conquest awaits.

. "But it's a mirror image of the whole [illegible] constellations are re[illegible] their relations to one another. . . . It is as though the galaxy were spread out on a sort of mercator's projection!"

The Gimlet

By Victor Endersby

IF we give the subject any consideration at all, doesn't it seem as though man really leads nearly a two-dimensional life? He has never risen a thousandth part of the diameter of the earth above its surface; he has never gone but a fraction of that distance below. How far has man gone below the liquid plane of the ocean? What might not be hidden within the bowels of the earth? More and more we turn our minds toward the further delving within the ocean depths and within the depths of the earth. And it seems to us not altogether reasonable that we should assume that there would be nothing new to be found at the greatest depths. Our new author has devised a truly ingenious method for "looking inside the earth" in this clever yarn, though he adheres closely to sound scientific facts, which, being an engineer, he is qualified to do.

Illustrated by MOREY

"HRRARPH!" remarked George Balsey, sailing his magazine at the fireplace with more emotion than accuracy. The unfortunate volume, which happened to be mine, struck the mantel and fluttered to the floor, where its spread-eagled leaves curled gently in the heat from the grate.

"Now what?" I inquired, with a bit of warmth of my own.

"Oh, these so-called 'interplanetary' stories! If the writers were all lumped together they would assay about enough real imagination to enable a cat to come in out of the rain!"

"What?"

"You heard me! Look through forty carloads of this trash"—he waved disdainfully at the abused magazine—"and see whether you can find in one single 'interplanetary' story the glimmer of anything except combinations and recombinations of functions, mechanisms, and emotions all too familiar on the home-ball of dirt, tinkered together with all the lively spontaneity likely to be displayed by a farmer building a hen-house! And when they try to liven things up with a bit of 'love-interest'—gosh!"

This was getting a little too much. Although my course was engineering, astronomy was my hobby, and some of the stories thus severely criticized—George was *so* intense—supplied the starting point for trains of imaginative thought, which decidedly moonlighted the sober college pathway paved with mathematics and mechanics of materials.

"Well," I said, "it's a pretty well-known psychological fact that nothing can be conceived whose *elements* at least do not lie in past experience. It's so in all literature and art. The imagination comes in the construction of new combinations from the old elements."

"All right; but why be so stultified? I could go out here on the campus and in fifteen minutes find two brains, whose respective outlooks and thought-flavoring would present more contrast than any difference I have yet seen described as existing between human beings and inhabitants of other worlds. Yet the most primary common-sense shows that such inhabitants would of necessity be so differently organized from us, as to be wholly beyond our power of conception. Flammarion, the first real speculator on these things, showed that very clearly. Now to my way of thinking, we ought to *do* something to explore the infinitely more interesting—and more accessible—regions near at hand, instead of sterilizing our brains on these long trodden treadmills."

"What regions, for instance?"

Balsey leaned toward me, his long nose quivering with eagerness and a glinting light in his eye.

"Go two miles into the ground," said he, "and you will be in space never yet penetrated except by the power of imagination; go ten, to find matter in states of which physics gives us only the most fallible and speculative ideas; go two thousand, and you will find yourself in the heart of the most contradictory mystery—short of Einstein's brain—which has ever perplexed a respectable branch of science. And as an honest-to-goodness student of geology—I said *student*, not a college boy tossing an occasional sop to the faculty in the way of study just to be able to hang on to the academic social whirl—I know what I'm talking about!"

"All right, Mista Bones. What's the big mystery?"

"This. The calculated weight of the earth gives it an average specific gravity about five to six times that of water. The surface rocks only run about two and a half, most of them less. There are something like three different ideas as to why this is; various authorities calculate that the core is composed of unusually heavy stuff running anywhere from gold to iron, with the size of said core necessarily varying. One duck says glass—why, I don't know and neither does he.

"Under tidal action the whole globe shows a rigidity about that of steel, which seems to check up with the calculated weight more or less. But now look at this: (Incidentally I am aware that you know all this, but I'm showing you how to *think* about it.) An earthquake sets up two kinds of earth waves; one runs around the crust and the other goes straight through the material direct to the seismograph. But if the center of shock is so far around the curve that the straight line wave path cuts below a certain depth, *it doesn't get there.* That indicates one of two things—either the core is pretty completely liquid, or it is hollow; the wave just falls into a vacuum, as it were. Liquid doesn't jibe with the rigidity; a liquid core of that size would leave the earth about as resistant to tidal action as a rubber balloon filled with mush. And there is no known sanction in physics for a hollow center—in fact it would upset our entire physics of astronomy, to say nothing of the weight business."

"Well," I said practically, "just what do you propose to do about it?"

GEORGE suddenly shed all levity.

"Bill," he stated, "this thing has haunted me for years. We actually know a thousand times more of the composition and life-history of the farthest visible star than we do of the deeper rocks under our feet. I can put up with a large volume of the unknown when I can look at the location of it with my own eyes; it takes the curse off the mystery; but the stars are prosaic as compared with the unfathomable underfoot; an unfathomable volume, whose surface manifestations from time to time mean life or death to the human race. Some day, so help me Hannah, I'm going to poke a hole into this crust, further than anyone has ever dreamed of going—except in fiction!"

"Then, as a matter of practicability, you're biting off a bigger chunk than any interplanetary dreamer. So far as they've gone with the rocket idea of flight, there is no engineering impossibility in traveling to the moon. When some bright lad finds out how to do it and get there alive, it may actually be done. But Lord, look at what you're up against to go even a few miles into the crust." I began to warm up to the subject a bit myself.

"Suppose we take as a minimum weight for the subsurface rocks, one hundred and fifty pounds per cubic foot; or for simplicity call it a hundred and forty-four which gives one pound pressure per square inch for each foot depth. At a mile you have over five thousand pounds per square inch, which is crushing stress for plenty of rocks. To get the crushing strength of steel, you have only to go seventy thousand feet, or about thirteen miles. At that depth practically any known rock would flow. A few miles further and no known material, in however small a tube, would keep a hole open. Yet even there you will only have scratched the orange peel, while the deepest holes ever actually sunk have been about eight thousand feet—in a California oil-field. Get down a thousand miles, and you have over five million pounds per square inch! No one can guess in what state matter would exist at that depth.

"But we have not even bothered with the matter of temperatures. At such depths, provided the increase of temperature holds with accepted observations, any known substance could exist only as vapor, except under tremendous pressure. As to keeping an open hole—! No, George, you'd better turn your efforts in the direction of a journey to Mars, with the object of proving how unimaginative the fictionists are. There's at least *some* hope in that direction."

"And after all that verbiage," George remarked sarcastically, "all you've said is that the job can't be done with *ordinary* methods!"

"Nor with any extraordinary ones conceivable to the mind of man!"

"Of course you have bounded the infinite and unscrewed the inscrutable long since, with your engineering formulas and characteristics of materials. But I just have a dim shadow of an idea that there may be a totally different method of attack outside the realms of engineering as now known—that there *might* be some way of holding back those pressures, of neutralizing those temperatures, with materials and energies yet to be developed."

"Well," I said, "there is *one* type of wall capable of standing such pressures—*the wall of an atom!*"

George gazed at me solemnly, a kindling fire behind his eyeballs.

"Gosh, that's a thought!"

It hadn't occurred to me that it was; I felt flattered.

"All right, then," I said, "when you get your trained atom ready to sink to the center of the earth, and get yourself comfortably seated on the nucleus, just call me and I'll come take a look!"

That didn't register; George had obviously started off on some inner trail, dropping a portcullis behind him; and the conversation feebly petered out for lack of nourishment, until I gave it up and turned to on my books. George spent the rest of the evening mooning in a concentrated manner, and scratching aimless diagrams which occasionally approached a semblance of sense but never quite reached it.

In succeeding days I became aware of the fact that that careless conversation had bitten deeper than I had anticipated; George had seen an opening into one of those fool problems which periodically engrossed his speculative attention, and I became slightly conscience-stricken over the heedless words which had led him to waste time on such a wild-goose chase.

I became considerably more concerned at the beginning of the next semester, when he registered for an extra course in intra-atomic physics, while his reticence indicated that he was actually following up the dumb idea, but was taking no chances on being laughed at over it.

I THINK that in course of time he would have gotten over it, but for an incident during our graduate year, which threw him back hard upon his hobby for an interest to keep on living by. His girl died. That doesn't amount to so much these days ordinarily; but George's life had been wrapped up in that girl for several years, without any apparent decrease of fervour—not that I could blame him—judging by what I knew of her. The shock quite jolted him loose from normal things, and tasting by

experience the sweet forgetfulness which comes from intense concentration, he turned all his energies along the lines of his increasingly absorbing interest—apparently afraid to let himself think of other things. It was all a great grief to me; these real and deep attachments—like what the Victorian novelists used to write about—are so rare in these days of matings and partings as casual as those of cats on the back fence, that it seemed an intense pity that two, who could have known deeper things than ordinary people; should have been pried apart like that.

Anyhow, even before the completion of our course, George and I, though as friendly as ever, had drawn markedly apart in mutuality of interests; and the subsequent five years deepened the gap. I worked hard at my profession in this and that hole and corner; George went into the research laboratories of the Universal Electric Corporation, relegating his old love, geology, to second place. After four years of that, during which one or two bright ideas had elevated him somewhat above his contemporaries, but not to any special place of eminence, he came into a wad by inheritance; I heard indirectly that he then secured water rights on a High Sierra stream and was building a private power house.

Early in the spring of the subsequent year, I was startled to get a letter from him, inviting me to pay him a few weeks' visit at his mountain lodge near Huntington Lake, out from Bakersfield in the San Joaquin Valley. It was about time for my vacation; I liked the mountains, and along with the prospect of renewing a friendship, which had been close once and might be again—together with a goodly admixture of curiosity—I accepted quite eagerly. I found George seemingly in good health, considerably mellowed in manner and mannerisms by the years, and glad to see me. It was obvious, however, that the last of his college superficialities had gone; he was very evidently a man whose life had turned inward, ridden by some train of thought, whose intensity rendered ordinary interests only moving shadows to him.

I was much surprised at the magnitude of his power plant; he had made some arrangement with a power company to pass their supply through his turbines and on down-stream, and had a plant sufficient to supply a large city. He was quite alone in the place. After a typical mountain meal cooked by himself, he turned to other matters.

"I brought you here, Bill," said he, "not merely to renew friendship, but to see my 'trained atom!'"

So! Then he had either actually worked out something—or was worse in need of a friend than he knew. I did not feel easy; the expression of his face was too intense, too absorbed.

"Well! That's interesting! Shoot—but load with words of one syllable!"

"You need not be *quite* so solicitous," he smiled, eying me keenly. "Or, anyway, save some of it for yourself. I may as well go into the matter fully. It was your reminder of the 'wall of an atom' which started me on that line—which is one reason you are here. I began to think. The wall of an atom *is* capable of resisting any pressure short of that found in some of the giant stars. It is the kinetic force of the spinning electrons—together with their magnetic fields, perhaps—which keeps the nucleus isolated in a sort of vacuum—so far as matter is concerned. Now the idea which struck me was, suppose that one could create a sort of super-atom large enough so that one could really 'sit on the nucleus.' One could then observe from inside as through a glass wall, untouched by either pressure or vibrations from outside; the whirling electron-shell would form a sort of diving-bell, in which you could descend into molten rock at any depth without harm.

"But very simple calculations showed that the formation of such a super-atom, even if the procedure were found, would require putting into the electrons more energy than is found in the whole solar system. Nor could any matter ever get into or out of it, once formed. Then it struck me—suppose one could keep an opening in it? And right along with that, came the idea that if an opening could be maintained, the thing would not have to be so large, because some very minute form of observing instrument could be inserted inside. This led logically to the conception of a *cylindrical* atom. The ordinary atom consists of a series of electrons whirling in orbits inclined in numerous directions to one another around a nucleus built of protons and some electrons for most elements. The electron-shell is thus spherical. *But why not a cylindrical atom whose electrons would revolve around a bar nucleus?* If one could find some way of disintegrating matter, the scattered protons and electrons would instantly seek their affinities, forming new atoms of various kinds. Supposing disintegration possible in the first place, why could not the reaggregation be controlled to form a new sort of atom? I conceived the idea then of applying disintegrative forces to any matter which was to be penetrated, meantime supplying a magnetic field of such nature as to cause each successive group of electrons and protons to add themselves on to a lengthening cylinder already established.

"FROM that point I began to get in earnest; it was then I decided to spend all my spare time on intra-atomic research. From the first the magnitude of the problem was manifest. First, disintegration of matter requires a tremendous input of energy, although the practicability of doing so within the limitation of available energy may be admitted. Second, the nature of the tremendously powerful field—magnetic, cohesive, gravitational, whichever you want to call it—between the nucleus and the electrons, was wholly unknown; is yet except right here. Its equations had to be discovered, worked out, and the means to control it found.

"The huge size of the necessary atom was another sticker. At first calculations it appeared that a half-inch between the bar nucleus and the electron cylinder would be the minimum possible in which power wires and perceptive instruments could be inserted. Whether such diameter would be practicable could only be determined by finding out the underlying laws of atom-formation and of the intra-atomic field. While I was accomplishing a certain amount of progress, there came along Hersinger's admixture, which, applied to quartz glass, would cause a rod of it to crystallize in such a manner that a definite image could be transmitted through the rod, the end crystal acting as the receptive lens. Thus one could see quite clearly around a corner with such a rod; you will remember that in the 'twenties' quite a bit of practical use began to be made of the light-transmitting qualities of quartz glass. So I figured out that if one could push a cylindrical atom into the earth, keeping inside of it beside the nucleus an image-transmitting quartz rod, and another plain rod to carry light down

from the top, one could magnify the image at the top and get any information he wanted as to the nature of the material passed—so far as sight goes. I was further helped by the contemporary discovery in the Universal Laboratories of the new alloy which was given the trade name of 'conductium'—a substance of such nature that a microscopic thread will carry electric currents which used to require heavy copper wires. As you know, it revolutionized electrical power transmission.

"Putting together a few of my own ideas with everything developed year by year by twenty or so of the great scientists, who were working along atomic problems, I finally discovered what appeared to be the key field-equation. I knew *how* to create an atom of any size—next thing was to do it! The observing apparatus, I found, could be carried down a tube not over an eighth-inch in diameter. The size of the power lines of conductium would of course depend on the size of the atom, as well as upon the rate at which one expected to disintegrate matter and add to the length of the cylindrical atom. I figured that about the minimum length of time I wanted to spend on reaching the center of the earth—4000 miles—was five years, or eight hundred miles per year. That figures to about two and a fifth miles per day, which would also be slow enough to make full observations of the material passed. Finally I worked out that the necessary rate of disintegration for a one-eighth inch cylinder, would allow of the transmitting wires to be put in the same size cylinder. Thus the final picture was a cylinder an eighth-inch across, revolving around a bar nucleus, with two conductium threads and two tiny quartz glass rods spaced around the nucleus. The glass would have to be drawn by special apparatus at the top and lowered as the end of the cylinder grew.

"Of course, I had no idea of putting into the electrons even a millionth of the kinetic energy, which they would contain; it was simply a matter of teasing them into leaving their original orbits and jumping into the new ones, retaining all their energy. That was a matter first of jolting them loose from their original locations and furnishing a field which would guide them into the new. The apparatus to supply that field, fed by the conductium wires, is quite microscopic, very complex, and along lines which I couldn't describe, because I couldn't understand it myself, if I hadn't lived with this problem for five years."

"BUT how about the tremendous energy released by breaking up the atoms? I thought it had been calculated that it would be enough to blow the planet to powder."

"Bosh! Millikan showed as long ago as 1928 that atom-formation is a power-emitting process; though in spite of that a lot of misguided idiots persist in talking about using 'atomic energy.' If you want to get explosive power out of matter, you will have to do it by making atoms, not by breaking them—a very wise provision of nature against human foolishness; nature having likewise thoughtfully omitted to supply any atom-making materials. In fact, I have to use a God-awful amount of power at the end of my tube; that increases the kinetic energy of the atoms attacked, just enough to spring them out of their orbits to where they are caught and held by the end-protons of the bar nucleus. The big problem was to furnish a cylindrical field, the normal atomic field being spherical.

"So far so good; but when I got to practical applications I found I'd hardly started. In the first place, the huge diameter of my cylinder, almost astronomical in comparison with a normal atom, made about the same difference in the nature of the field as there is between the field of a kid's magnet and the gravitational field of the sun. Following some preliminary experiments, I had to figure out a new set of field equations, which were neither fish, flesh, nor fowl, so far as any previous ideas were concerned. My atom is really a pseudo-atom—a mechanical device rather than an atomic one. Then the effect of the transmitting wires and rods had to be taken into consideration.

"The ordinary atom has no such gadgets between its nucleus and shell; and I found that condition to be another monkey-wrench in the machinery. Then came the question: will an electron-shell, dense enough to stand such great pressures, also transmit the light necessary for observations? And if it transmitted the light, would it not also transmit enough heat to destroy the apparatus? Well, I found that the transmissive qualities could be modified by varying the handling of the field; and I arrived at a density which would keep out matter, transmit light, and keep out dangerous heat. But I also found that light transmitted through the inner field of an atom is something very different from light through space. That led to some chemical research and modifications of the quartz lens. I finally had to run some extra conductium thread through the quartz and introduce an apparatus to modify the light rays in order to get a correct picture. That was penultimate; the final step was to verify the accuracy of the work by pushing the cylinder down to known strata and examining the transmitted picture of the rock texture for comparison. After a long struggle I got a true image; and—the probe is ready for the patient. Want to see?"

I did—not unnaturally. We passed through an echoingly silent power-house to a small room, doored somewhat like a bank vault, with immensely thick walls. George explained that not only was this the case, but that some of his apparatus was mounted on special foundation materials to eliminate earth tremors and vibrations from the power-house. The center of the room was occupied by a large bakelite fitting, into which entered three very heavy insulated cables. The inside of the fitting was so thoroughly boxed off that I could guess nothing of the details.

"It isn't an ordinary current that I use—in any sense," explained George. "And it isn't used in an ordinary way. To expose any of the carrying fittings to the air would be dangerous; anyway, I've got uses ahead for this thing when I get done with the present job, and I don't wish to expose it to any unnecessary publicity. See those wires?"

Three tiny filaments of conductium dropped from the fitting through a minute hole in the concrete floor, accompanied by thin quartz glass rods; they did not occupy as much space as an ordinary copper power wire of medium size. I saw nothing peculiar about them, except that now and then I sensed an evanescent bluish haze which seemed to surround them.

"Take a swing at them with this," he said, handing me a heavy steel bar, "but watch your fingers!" I looked at him questioningly. It seemed like a rather pointless destruction of apparatus which, whether worth anything or not, must have taken time and money to produce.

"Go ahead!" said George. Moved by curiosity and the little imp of destruction which nests in every human breast, I did so, putting plenty of vinegar into the wallop, while I was at it. The bar clanged across the room, rebounding from something which gave me the impression of greater solidity than anything I'd ever encountered; I nursed my stinging fingers and swore with devotion, while George went off into heartier laughter than I had seen him exhibit since his tragedy.

"*That was my atom you hit,*" he elucidated. "My little, fragile, eighth-inch atom!" I looked at the faint bluish glint more in awe than in anger. Of course; a thing which figured to stand earth-core pressures would hardly be phased by the application of a mere steel bar, however vigorous. A queer feeling stole over me; it was incredibly before my eyes, that George had done the thing he had set for himself. I felt like one who has dreamed of seeing a foreign country all his life, his pictures thereof becoming so flavored with the dream-feeling, that he cannot immediately sense the reality of its first-seen shores. The odd, weird foreboding which I then began to sense, and subsequently never quite lost, was not very rational; but even so, it was but a puny prophetic measure of what later came to pass.

THE quartz glass rods extended through and above the fitting, into an apparatus fitted with a large lens, through which the light, after passing, was directed at a tall, thin ground glass screen about five feet high and six inches across. Back of the lens apparatus stood what looked like an electric furnace, mounted on a standard in such wise that it could be swung sideways. At one side of the glass stood a powerful microscope, likewise mounted, and on tables around the room, was an assortment of gadgets, with some of which I never did get particularly acquainted. They were added to from time to time during the odd months which followed.

"Gosh!" I remarked. "How far have you sent it down?"

"Only about three hundred feet so far. I just wanted to make sure it was all right before I got you to watch the actual tryout. It's like a show—you never can really enjoy one alone." The note in his voice on the word "alone" struck me rather sadly; a thought passed across my mind that there was a little morbidity here.

George threw a guarded switch, and the air began to hum faintly but pervasively. Upon the ground glass an image appeared. I stepped curiously around and inspected it. It was the perfect representation of the texture of granite, magnified about two hundred diameters. The rods glowed brightly.

"About a foot from the bottom," George explained, "the receiving lens of the quartz rod is turned toward the wall of the 'atom.' That gives me an image about a thirty-second of an inch in diameter, which is magnified on the screen as you see. The great clearness is due to the quality of the light, which I am able to transmit through the other rod. If I want a closer examination, I just swing the microscope into position to inspect the back of the screen, and can magnify the rock texture to nearly any size I please. So I not only have a unique scheme on the whole, but a system for mineralogical exploration which rather goes beyond anything yet, so far as the microscopic end is concerned. However, I've never been able to get a start on bringing actual samples to the top. Everything inside the 'atom' shell is destroyed during the re-creation process, and I can't get anything through it afterward—you know that; you've just tried it!" he grinned.

"I think, though, that microscopic and spectroscopic examinations will give me everything worth knowing about anything I strike." Ah, how tragically inadequate did that idea turn out to be!

George hoisted the apparatus up until the image fell near the top of the screen; then pulled another switch. The lens traveled rapidly down along with its image until near the bottom; there was a click, the lens rose again to the top, minus the quartz glass rods; the furnace thing swung around, engaged with the lens machine, then clicked away again, leaving the rods restored; then the lens ran down again. The whole cycle took about thirty seconds for the five feet, or two inches per second, which gave time for a watch on the texture thrown on the screen. In case of anything unusual or interesting, the thing could be stopped for a detailed examination. Meantime the observer could sit quietly and watch the business go on automatically.

Enthralled, we spent the entire night watching the passing strata, the tip of the atom by morning being nearly eight thousand feet down, having been in monotonous igneous rock for the last two thousand or so, after passing through numerous interesting but not remarkable stratifications. George then sprung a new one. He set in place a compact little movie camera, mounted on another of those sliding standards, and electrically driven. It synchronized with the vertical motion of the lens, automatically recording the image thrown on the screen.

"Whenever I am away from the apparatus," he said, "I just set this going. Then, when I come back, I have the image automatically projected an another screen, keeping an eye on both at once. If it should turn out that I missed anything special while away, the lens at the end of the rod could be raised back to that level for closer examination. Otherwise I would have to hire two trained observers to help me, or miss about two-thirds of the scenery."

"And just what do you expect to find on this long range tour?"

"I expect to find more or less interesting minerals, and maybe some valuable geological information, for about two thousand miles down. After that I am carefully not expecting anything, because whatever I expect, it will be different." Well; his foresight was good, but his estimate of distance not so good.

On this occasion I stayed with him two weeks, during which time the probe went to about thirty-five miles without encountering much of great interest except two pockets of white-hot matter. The combination of great heat and pressure produced some spectroscopic modifications which no doubt were very interesting to professional physicists, but meant little to me. The material was ordinary molten magma.

BACK at my own business, pondering from time to time over what had been accomplished, it dawned upon me gradually that erratic old George had come to be one of the foremost, if not *the* foremost, in the land of science. To say nothing of the wonderful possibilities in practical application to subsurface exploration, he must have mastered not only everything hitherto known of atomic physics, but about twice as much more. Had

I been in his place, I would by this time have been lecturing to vast audiences and organizing mining companies on an entirely new scale, instead of soberly poking day by day further into the earth's monotonous innards.

So I went on about my business, determining more and more to make real use of George, when he got over his present experiment. I sounded him out gently on the subject once or twice, but got no rise, and decided to let the fever run its course, though keeping in fairly close touch. The atomic drill bit on and on until the second year and the eight hundredth mile were reached. Then things began to liven up. George had been busy most of his time digging into new applications of spectroscopic analysis, that and the microscope being the only means by which he could penetrate the wall of his "atom," which shut him off from contact with the rocks a hundredth of an inch away as effectually as the starry reaches of space withhold the astronomer from burning his fingers on Betelguese. In the course of time he found a means of measuring not only the heat of the rocks, but the pressure on them. Both heat and pressure had gone according to Hoyle for about five hundred miles, being almost incalculable at that depth. One thing he had wanted to find—whether the rock was liquid at such depths—he had not been able to determine. In fact, the word had no meaning under such pressures and temperatures. No doubt a fragment of solid suddenly transferred from that depth to the surface would have exploded instantly into incandescent vapor. But even the glowing materials occasionally found at first, ceased. Evidently the atoms of the material down there were held under such pressure that they could not radiate light.

But at five hundred miles the story began to change. The monotonous character of the rocks altered, giving way to metals more and more; the lighter metals, of course, came first, then heavier and heavier, without any definite demarcations. But also about this time both temperature and pressure ceased to follow the old rules of increase. They began to grow less rapidly. And when at nine hundred miles nearly everything had disappeared except such heavy stuff as platinum, lead, and gold, George began to get feverish; and for that matter, so did I. Being his only confidant, he called me in to check up his analyses, and particularly his calculations of the weight of the earth derived from the strata encountered. This last was positively disquieting. The weight of rock per cubic inch had increased measurably for a long time past, owing to the great compression. The same was true of these metals. *But even with the old weights, the mass of the earth figured out to be many times what any scientist had calculated it.* And it was a cinch that the gold and the rest were not floating on some lighter metal; if anything, the material would go on getting heavier. It even appeared reasonable to suppose that there would be just so much gold, and that then we might find some new element much heavier.

At this point the thing began to haunt me. It was evident that we were on the track of something which would upset the science of celestial mechanics in some direction or other—provided we could get someone to take stock enough in the stuff to check up on it. Pressure and temperature increase continued to slack off until the thousand mark was reached. At that point or thereabouts they were at their maximum but had been nearly there for some time previous.

A FEW weeks later I got a hurry call from George. "COME QUICK NEVER MIND JOB GOING NUTS I THINK," he wired. I don't know just what I expected to find, but anyway, what I did find was startling from one point of view and prosaic for another. He handed me the reproduction of a spectrum. "Mull over that while you eat," said he, "and see what you make of it." "Mull" was the word. The thing didn't resemble anything I had ever seen; and in the course of my mix-up with George, I had absorbed a lot of spectroscopic lore. George wouldn't elucidate. He said that he wanted to see whether I saw the same thing he did; so I found myself up against several hours of stiff study, during which he watched me eagerly, albeit wearily. Finally there drifted across my mind one of those feelings of something just beyond the grasp of comprehension. I groped after it painfully for quite a while, then I too saw. "But there ain't no such animal!" I said.

"Well," grinned George, relieved, "since we both see it, I guess there is; that is, if the calculus of probabilities still works! I'm beginning to doubt the accuracy of everything from mathematics on down!"

"But an atomic number of seven thousand, three hundred and forty-seven!" I gasped.

"Divide by ninety-three," he smiled, "then see if it looks easier!" I did.

"But that's the atomic number of gold!"

"Just so."

"I can't make any sense out of that!"

"Well, the last time I looked at the screen there was another on it; try that one."

Two more hours of labor elapsed, and there lay on the paper the mystic number, "7626."

"Do the same thing to that," he said.

"Lead!" I gasped.

"Yes! All right; now write your own answer to the conundrum! What material has an atomic number of 93?"

"Why, that's the beginning of the transuranium series, supposed to be found in the interior of the stars and to make up about 98 per cent of the matter of the universe!"

"In other words, we have before us the gold and lead correspondents in a series where the atomic number of the hydrogen correspondent would be 93, or just one beyond uranium, the highest known atomic number!"

George leaned back with a tired but relieved sigh.

"Well, it takes a load off my brain cell to know that there are two of us, anyway. Now just take your little pencil and figure the weight of the earth according to the new dope."

I didn't care to just then. The whole thing was getting a bit beyond me; I had a feeling of—well, almost of the supernatural, as though we were pushing beyond the boundaries of the allowable universe. I couldn't feel that I would ever walk on the face of the earth with a sense of familiarity again. What other weird mysteries did its tame countenance hide? As to the weight—in a dim way there crossed my mind the feeling that it would be more than the solar system had been believed to be.

Suddenly I sat up in more alarm.

"Ah," said George contentedly; "I see it struck you too!"

"You mean—the drill is now going through a *lighter* element?"

"Yes—it passed out of gold into hyper-gold; now it is in hyper-lead, the lighter element."

"Just as though it has passed the core of the earth?"

A strange medley of half-baked conjectures flocked chaotically through my mind. What was that about Einstein . . . Einstein . . . the curvature of space . . . matter in space. . . . Ah! Now I had it! The Einstein theory stated, first, that matter in space brought about a special curvature; second, that three-dimensional space itself was curved in a hyper-space. Was it not quite possible then, that the presence of such vastly heavy substance brought about a curvature, which shortened the earth's diameter to about half? The idea comforted me, because solid mathematics seemed able to get some grasp on it. God knows it was weird enough to think of a globe with a circumference six times instead of three times its diameter; but it was better than the formless ghosts which had begun to troop into my mind from outer space. If I'd really known Einstein practically, I would not have had even that temporary stabilization. Would to heaven the problem had been so simple!

I was rather glad to get away next day and bury myself in more mundane matters; though obviously what I had lost in complacency, George had gained in the comfort of knowing that someone else saw the same things, and that if the thing was a hallucination, it was a double one.

THE story of the next year was a continuance of the experience; element after element was penetrated exhibiting the same succession in reverse order, which had been encountered on the way down, but all showing that multiplication of the atomic numbers of surface elements. The incredible stupidity into which the strange experiences had bludgeoned my brain may be measured by the fact that I did not realize for a month that the drill *could not* be approaching the other surface; otherwise the world would be an entity lopsided to an incredible degree, because of the difference in weight!

Again the sense of a haunting ghost just beyond the grasp of the mind began to disturb me; again and again an explanation seemed to be at hand, but always mockingly retreated into the shadowy recesses of my cerebrum. Broaching this to George, I found that he had never for a moment felt that the explanation lay anywhere in the sane mathematics of Einstein or of anyone else. He had simply ceased to speculate upon any explanation, and concentrated for the sake of sanity on driving his machine onward with the utmost possible speed, and upon working out a chemistry and physics for this new world of matter. From time to time we discussed the possibility of calling in some scientific authorities; but for various reasons never came to the point. Principally, I think, because we felt an intense desire to have a completed job to present; also partly because, without a sensible explanation, we would never be able to get scientists to investigate far enough to convince themselves that it was not all a fake.

Finally the time arrived when premonitions of an approaching surface—by correspondential phenomena—began to show up. I took leave from my job and stayed with George, both of us practically living on tiptoe, hardly eating or sleeping enough to keep sane. We no longer left the recording of any part of the tale to the automatic movie, but stood watch and watch, four hours at a time.

It was in the middle of my watch off, on one of the those cloudy, lowering, mysterious nights when anything seems possible, that I roused wildly out of a heavy lethargy to become conscious of George's frantic grasp.

"Bill, shake out of it! For God's sake make it snappy!" he yelled.

Yanking a bathrobe around my shoulders, I stumbled sleepily and somewhat terrified, to the little room. I think that I would have been prepared for anything except what I saw. Gigantic caverns populated with strange monsters; the very flames of Hades, I think, would not have been so disconcerting.

He had some time since rigged a screen covering a whole wall of the room, and introduced much improved magnifying apparatus, so that the lens could now be stopped down and an image ten feet square thrown. Such an image now rested on the screen; and if we had not known that it emanated from some source two thousand miles below our feet, it would really have seemed quite prosaic. As it was, its very seeming familiarity produced most of its terrifying weirdness. On the screen, then, lay a starlit nightscape. Under a glare of stars brighter than any familiar to us, lit as by moonlight on a moderately bright night, rolled a sweep of barren land, relieved by dim, gigantically high, mystically glamorous mountains in the far distance. With a great effort of will, we steadied ourselves, took seats and began to try to observe rationally.

The equality of the sky and the light struck us first. The stars were really of the quality of planets—myriads of them. They seemed to *swim* in some medium, rather than to be suspended in space. It was as though the whole of this strange space possessed a sort of crystalline viscosity; the stars and the air—if there was air—seemed *alive*. But the dim land itself, upon which nothing stirred, seemed to have such aloof, distant remoteness as is felt in those dreams where one seems to be traversing some infinite plain all alone in the Universe. It brought with it terror, the terror of utter loneliness, but mingled with it a strange, wild attraction; an attraction such as might be extended by the infinitudes of interstellar space to one miraculously made free of them. And as we grew calmer, and the image remained on the screen without alteration in any respect, there came a deep, seductive, insidiously pervasive sense of *peace*. Not the peace of temporarily satisfied desire, of ambition achieved, or of mental and physical comfort, but peace such as might be felt by one forever done with all mortal strivings, and attuned to changeless infinity and eternity.

It was not such a feeling as I had ever experienced and imagined; and I felt as though, were I to sit there much longer, I would be drawn out of all normal experience and character. Feeling a growing desire to yield and let that strange enticement take me whither it would, I jerked myself out of the spell with a strong effort and began to study details again, in an attempt to regain a scientific attitude of mind.

STUDYING the constellations, I saw about the fainter ones a queer familiarity, which puzzled me the more I tried to fathom it. Turning to George, I saw him sitting, rapt, with an expression which impressed me eerily He was leaning forward, gazing at the picture as though his soul were about to climb out of his eyes. There was a look of mental and moral hunger about his face which shocked me, and I realized that the strange attraction which I had shaken off had gone much further with him. I shook him.

"George! Do you recognize the constellations?"

He turned to me half-dazed, half-angry, sat up and pulled himself out of it.

"Of course not—but wait! Yes; there *is* something . . . something or other . . . by Gosh!" His lethargy fell off like a cloak.

"Mirror-images!"

"Yes. But it's a mirror-image of the whole sky, the constellations are reversed in their relations to one another."

"It's more than that; what about the sizes?"

How shall I describe the effect upon our minds when we finally comprehended that it was as though we looked upon our entire galaxy from an infinite distance away—from outside it entirely? That in this lorn sky that galaxy, faint in comparison with the rest, occupied but a small space, and not formed as a globe which one sees from a side only, but as though the galaxy were spread out on a sort of Mercator's projection?

We even thought we could pick out and see our familiar sun—a distant star!

For long moments we sat motionless, looking at one another "with a wild surmise, silent upon a peak in Darien!"

Finally, "Let's get out of here and take a sedative!" said George. "My brain's going!"

We stalled around for an hour next morning, clinking our saucers, uselessly stirring our cold coffee, and doing a thousand and one foolish little familiar things to help anchor us to the humdrum, and postpone the stress and strain of a renewed grapple with the Unknown. Finally we had to come to it, however, and the last few feet could not be passed fast enough. What kind of dawn would have overspread that dim land in the interim? But there was no dawn. That mysterious landscape lay stretched without change above or below, in a star-lit night which we now began to recognize was eternal. And with that thought came again that mysterious, terrifying seduction of peace, silence, and utter quiet. We busied ourselves with a bit of scientific analysis—I know of nothing which will take the glamor off anything quicker than that. We ran the drill on for a ways, which quickly determined that this landscape was reversed with respect to our own—that its mountains towered away from our feet. This was evident from the fact that the point of view rose in the air as the drill proceeded; without, however, vouchsafing any more information. We continued this until it became evident that all we would get would be more of the same, with a progressive dimming due to the growing height above the surface. Fearful of losing what we had, and apprehensive as to whether anything further could be encountered—certainly to all visual evidence we would be going on out into infinite space—we stopped the thing at about seven hundred feet, which turned out to be the final physical limit of the wild enterprise.

The day was spent largely in spectroscopic analyses. Investigations of this kind, carried out with feverish intensity, served to keep us from thinking and to stabilize our minds considerably. But every additional bit of information gained, but added another brick to the prison wall of incomprehension, against which we were battering our bruised brain-pans in vain.

At last, tired out, we faced one another across the table, too excited and nervous to go to sleep, too wearied for further experiment, and up against an *impasse* with nothing to grasp even as the merest handhold upon some line of ratiocination.

"George," I said, "this is altogether out of our depth. We've got to have talent and lots of it—or we'll soon be having a brainsmith tinkering with our works. Millikan is hale and hearty; Einstein isn't in his dotage yet; Eddington and the rest of the Englishmen are holding forth as usual; how about it?"

"Uh!" he grunted. "Remember Galileo?"

"Bosh! They don't burn people any more for scientific heresy!"

"No, not people! Only their ears! How about Nodon, Cazzamali, and Clark; even Dr. Osborne? Bill, knowing the scientific men that you do, would you risk your reputation and livelihood in trying to get those men to look at this thing? Or having gotten them to do so, could you convince them that it was anything but a clever fake?"

I PONDERED deeply, running over in my mind the many scientific controversies with which I had been familiar. Comparing our present situation with that of any discoverers of the past, it came to me that almost never had a discovery been accepted, even by the most open-minded men, unless it in some way were confined to the status of an extension, a modification, or correction of an idea previously accepted. To present seriously that which would immediately toss into the discard every accepted basis of scientific thought, except possibly in chemistry, and would expose our whole conception of the Universe as being as arrant a dream as the Ptolemaic system——! I thought of the years of sweating days and studious nights which had now brought me within reaching distance of a real place in my profession; I thought of the children and wife, whose future hung so on my continued advance; I thought of the polite, half-hidden smiles of my colleagues and superiors, of the many courteous but effective ways in which opportunity is blocked for anyone suspected of being a bit erratic in the head, and consequently of doubtful reliability for sober and responsible enterprise. It was just a bit too much for my courage, and I told George so; beginning to wonder how many times, in such a tricky universe, other bold adventurers like him had encountered some hinder side of the mask of things; had so encountered, and, like me, had prudently kept silent; or had been foolish enough to speak and in behalf of accepted sanity had been browbeaten and kicked into silence, or charitably immured in institutions where their ravings could not flutter the veils of our comfortable illusions. And the more I thought, the more determined I became.

"But," said George, "so far as I am concerned, there is more than that in it. Somehow I just don't want that world discussed; I don't want it—profaned." And I could share with him at least a substantial part of the feeling.

It is strange how adaptable the mind is. Within two weeks, though certainly the mad enigma did not become prosaic, we were learning to live with it in some comfort; we at least ceased to let it dash off with our brains on mad chases which exhausted us and left us at the starting point. I left then, and a month later received by mail the semi-final glimmer of rational light which was ever thrown into that tenebrous universe.

"The only trace of a path out," wrote George, "is

furnished by Einstein's theory of the curvature of space due to the presence of matter in it. If space is capable of curvature, it must lie within a hyperspace; if so it must be dimensional. Its curvature guides the progress of heavenly bodies, therefore it must be capable of resistance—inertia. And it is not hard to imagine that in relation to hyperspace it has also mass of some kind. Mass, inertia, dimensionality—do not those words spell *matter?* But if space is material, then why not any number of spaces lying side by side in hyperspace, each with its own laws, its own matter, its own boundaries, which no vibration from within may cross? Is it not a corollary of Einstein that a straight line, the flight of a ray of light, for instance, following the curvature of space, returns to the point of its source, unable to pass the boundary of space? *Suppose then that by some incomprehensible means we have penetrated into another space than ours.* Our laws of radiation need not necessarily exist there, nor any of our measures of time or distance; the hidden universe we have on view might be contained within a speck of our matter; yet comprise, on its own scale of magnitude, distances far greater than any in the universe viewable from the surface of earth. Since the measure of magnitudes in any space are as real as those in any other, space enclosed within our earth might be *really* as well as theoretically vaster than any we have measured without. When the boundaries of a space are passed, such relations as 'the whole is greater than its parts' cease to have meaning."

This, thought I, is verily Einstein squared—or perhaps with the square root extracted.

BUT I still had some cerebral cells of my own functioning, and I replied:

"Well and good; but am I to suppose that this one globe has such a trans-spacial center, and none other has it? Or that every heavenly body has such a center? Where would be the sense or reason in such a mad, wild scheme? Causality has been traced in every working of the cosmos; but where is the systematic development of natural law to result in such an order of things? And above all, what is the meaning of that distant view of our galaxy, seen from inside the earth?"

"Did you ever stop to think," he wrote back, "that perhaps there are only two divisions of space, with a single boundary between them? That such a boundary would be *limitless* in Euclidean measurement, and that the only limitless area we know of is the surface of a sphere? That perhaps a thousand miles within our earth lies the boundary between an inner and outer space balanced against one another, archetype of the eternal opposing pairs of forces which keep the universe in being, and that on our side is an accumulation of *our* matter resting upon the boundary, upon the other side an accumulation of *that* matter? Can you imagine that the limited sphericity of our globe is merely the manner in which finite minds represent to themselves the limitless surface of our space, and that in reality that space is no more *enclosed* or *inner* than ours is?

"If so, you can then perhaps take the next step—imagine that the objects of the one universe are *reflected* in the ether of the other. Since your visit, I have gone far in the spectroscopy of the stars in the other world, and I find them *constituted like the matter of earth.* That means that while our stars are transuranic principally, and our earth mundane, *those* stars are mundane, and the earth over which they soar, transuranic! Further than that, I have located in a far-distant point of the Milky Way, the miniature constellations of the 'inner' universe!"

Verily, I began to appreciate the feelings of those who threatened Galileo! Nothing on earth could ever be the same to me, or quite sane again, in face of such ghastly enigmas! It was in vain that I struggled for equilibrium. Why, if George were on the right track, centuries of devoted scientific labor had but landed us back in the midst of the old geocentric system, delineating us earth-dwellers as privileged inhabitants of the unique location in the universe—the boundary between its two halves! Once more the stars and the sun were hung in the heavens as lamps to light the crawling footsteps of man alone! There was at one and the same time a horrifying spaciousness about this conception, and a smothering constriction, which was most indescribable.

I came gradually, but firmly, to the resolve that, come what might, so far as I was concerned this secret would be guarded from mankind with my life. Meantime I felt the greatest eagerness for resolution of the questions as to the origin and destiny of the stars and their true relation to our earth; the place and magnitude of our planets, the rotations of the sun; why if the surface of our earth were really limitless, we had but measured upon it the area of the surface of a sphere eight thousand miles in diameter; and a thousand and one other thronging conundrums.

There were times when George and I together seemed almost on the track of solutions; but when I remembered that we were facing, alone and poorly equipped, the equivalent of all the problems which had busied astronomers since the days of Galileo, I despaired of any real progress in my lifetime; and ere long the last flicker of hope for further knowledge guttered out. For half a year after the discovery, George had been busy with investigation, calculation, and cogitation; but as time went on there crept into his communications a great mental weariness and apathy. That was natural enough; but I sensed by and by there was something in it more than a mere physical reaction.

His communications began to show a disquieting strain of mysticism; suggestions of a great longing to enter into the shadow region in a more literal way, and strange hints which did not easily connect up with the normal and natural. I began to feel a serious concern; and several times I planned to return to the Sierras to try to effect an influence upon him in which my letters seemed to fail. But I was frustrated by business demands which could not be denied, although tormented by a growing anxiety.

AT last one day I found my fingers trembling as I received from the carrier a thick envelope; a foreboding came over me, and it was with a great effort that I got the packet open.

"Bill," began the communication, "I may as well break it with the first words. When you get this, I will be gone. No, not suicide! I am not that sort of coward. But years ago I guess I lost the main anchor. The great discovery and the events connected with it put new life into me and let me forget—other things. Lately, however, it has become clear that I will never learn any more of the new world by scientific means—and, oh, you can never guess the irresistible, ungodly longing to enter into its shadowy, eternal peace, which has grown upon me

from the first! Of late, things have changed in strange ways, too. Hints of realities I could not get through physical means have begun to come to me in other ways as I watched the vision on the screen; faintly, at first, then clearer and clearer.

"There *is* life there, Bill! Not life as you and I have thought of it, but life which sees and feels through the stones and the stars; motionless, changeless life, of which, so help me, we mortals may become part. The ancients were right; that realm lies not merely the other side of a thousand miles each of earthly and transuranic matter, *but the other side of death!* I am fast passing thither, and it is only a matter of days; but I have made provision for the complete destruction of the plant and laboratory, burying the latter under hundreds of feet of earth blasted from the hillside. The 'atom' cannot be pulled out or driven down by any human power; but I know now that it is unlawful for any human eye to look down that rashly driven tube, nor is it well for others to guess what we have seen. Therefore—burial.

"So soon as I write this, I shall be moved to the hospital in Bakersfield, leaving a time mechanism to effect the destruction. I will make arrangements for this letter to reach you only after I have gone; for I do not want you to come to see me, and have to meet in your eyes the pitying accusation of madness. I have left to you the sizable remnant of my fortune, in trust for the purpose of helping to so educate humanity that when in the course of years—ages, perhaps—it dawns upon man that things are not what they seem, and that for reality he must look ever *within himself* and never outward, that realization will bring madness to as few as may be! Good-bye, Bill!"

Poor George! How utterly alone I felt, crushed by the weight of knowledge I must carry silently to the grave—to the *inner universe!* Now, what madness was this—was I also raving? The ancients—what were the ancients right about? Reminiscences of forgotten mythological studies floated into my mind, took shape, and stood before me stark. Why, of all religions, Christianity alone had taught the skies to be the abode of the fortunate dead! The Greeks had their afterworld below *—in the realm of shadows!* There also was the Egyptian Amenti. And did not the Hopi Indians sing in memory of those who had taken "The Trail of all Trails—the Trail to Those Below?"

I shook myself loose from this train of thought, and for sanity's sake began a rational consideration of the weird mélange. What a fool I was! George had studied mythology as well as I; he may have forgotten the old eschatologies consciously, but his subliminal self had not. Sapped by an enduring grief, normal earthly appetites weakened, worn by the battering disappointment presented by the new universe he had discovered, torn by the longing generated by a world of mystery into which he could never physically enter, he had weakened *pari passu* mind and body; had dreamed dreams and seen visions in that state where the inner vision becomes pliable to the wish; forgotten mythic lore had crept stealthily upon his weakness from the unguarded recesses of the older, the irrational mind, which is the heritage of man, be he ever so modern; and *facilis descensus!* And so, a mind which could have been of incalculable service to man, had been dragged into useless destruction by an overstrong imaginative genius harnessed to many unconscious weaknesses.

THE END

Synthetic

By Charles Cloukey

(*Continued from page* 138)

second to spare he put his throttle on and the gray and green comet crashed into the white destroyer. They fell together in a twisted mass of metal and flames. It was the only possible way he could have stopped the white plane from passing the third time over the ship that carried her whom the synthetic man loved. I looked at my watch. Less than eight minutes had passed since I had taken off, yet it seemed an eternity.

The cabin plane landed safely.

Bob Nelson's life was short, and his death glorious. As I stood there it came to me clearly, beyond the shadow of a doubt, that the synthetic man had a soul.

THE END

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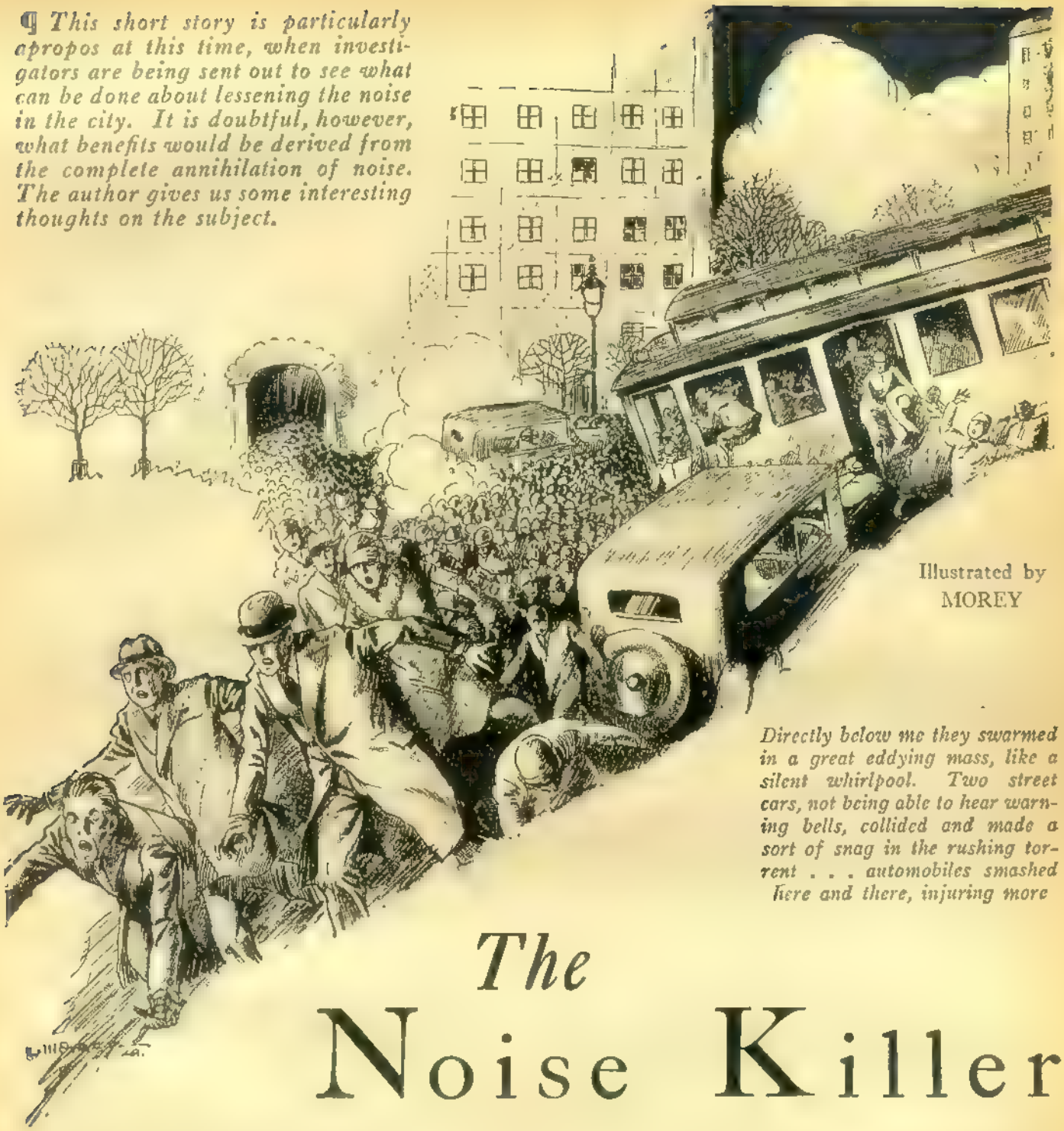
¶ This short story is particularly apropos at this time, when investigators are being sent out to see what can be done about lessening the noise in the city. It is doubtful, however, what benefits would be derived from the complete annihilation of noise. The author gives us some interesting thoughts on the subject.



Illustrated by MOREY

Directly below me they swarmed in a great eddying mass, like a silent whirlpool. Two street cars, not being able to hear warning bells, collided and made a sort of snag in the rushing torrent . . . automobiles smashed here and there, injuring more

The Noise Killer

By A. M. McNeill

THE strangest experience of all my flying days never got into a report for two reasons. For one thing I was afraid of losing caste with my superior officers if I had handed in an exact record of what I went through. They would probably say that I had become permanently light-headed from the altitude and was not to be trusted with another 'plane.

Nevertheless, if the report of my last attempt to establish a transcontinental non-stop flying record had been complete, it would have told of that foggy sky out of which I dropped to a place hard to believe of this world.

I had been bucking head winds for several hours when suddenly my engine stalled. With so much depending upon keeping in the air, I put her into a tail spin with a pretty sick feeling. The cloud bank through which I cut in a hurry was much thicker than I had expected. When I straightened her out I was almost uncomfortably close to compact white buildings, piled in neat square formations of a city. Then it was I saw that I must land for minor repairs to the fuselage received in my steep climb and swift fall. Knowing that the chance of making the coveted record was lost, yet still tense with the effort, I cruised about over the city for signs of an airport.

Of course there was the great wide river upon which to settle in case of need. At last I sighted an open space

on the margin of the river and tried to read a name painted on the hangar's roof. Some letters must have been obliterated for all I could read was a terminating "ville."

It was the most deserted haven into which I had ever taxied. Overcoming a sense of unreality I ran across the tarmac to rattle locked doors and frantically shout for someone to get me the needed materials. Not a sign of life could I raise. At last, concluding some important occasion had perhaps called everybody uptown, I went off at a great heat towards the main thoroughfare.

The moment my stamping feet left the soft, dry grass of the fields for the hard pavement I knew for a certainty that something was very wrong. My heavy boots made not a sound. I might have been walking on cotton wool. For a horrible moment I knew the feelings of a person who learns for the first time he has lost one of his senses. I thought I must have become deaf. Perhaps the sudden change of altitude had brought it on. Sometimes I had known a throbbing in my ears from such a cause. I shook my head until I thought it would fly off and pounded both sides of my skull like a madman, but still my footsteps were inaudible.

Unable, as it were, to believe my ears, I went on for further signs that would prove my deafness. Though I walked the length of the principal street on which the city hall tower rose tall and alone I met only staring windows, echoless walls and empty sidewalks. Papers swept past me without a rustle. A bird perched on a telephone wire quivered with a burst of silent melody. A hungry looking mongrel rushed out to bark without menace because without sound. I picked up a stone and heaved it at him. It hit the asphalt as noiselessly as a wind-blown feather.

"Have I gone crazy?" I asked myself. "Or did I bring down my 'plane in an unexpected crash that sent me wandering in outer Hades?"

Just then, to my inexpressible joy, I sighted a 'plane passing overhead. Assured that I was still on earth, I watched it fly close only to be plunged into deeper bewilderment. It was accompanied by no familiar throb of the engine. Letting out my breath in what should have been a yell, I waved my arms frantically and ran back toward the airport. My lungs were heaving with great, noiseless, panting gasps. I never slowed down until I came within sight of the open field of the airport and the blessed spread wings of my own 'plane. Here was something familiar. If I were in the other world I had the comfort of knowing my old ship could be there with me.

I flopped down in the shade of a wing with a great heaving sigh. As I lay there in its homelike lee it suddenly occurred to me that I had heard that sigh. I sighed again just to prove it. Sure enough! Excitedly I sat up and shouted, "Whee! Yippee!" like an Arizona Indian.

THAT yell immediately brought results. The moment it ceased I saw cautiously advancing around the rudder of my ship the scraped shoes and frayed pants of a man who finally peered under the wing at me, his little blue eyes squinting and his white bearded chin working in agitation.

"Are yuh hurt?" he finally said.

"No! Just frightened!" I saw no chance of hiding the fact. When I tried to gain my feet, I was so weak from shock that I sank back upon the ground again. The old fellow stooped and drew himself slowly under the wing on his hands and one hip.

"This is the hell of a place!" I blustered to hide my shaky voice. "Are you alive or just walking around to save funeral expenses?"

"Oh, I'm alive," he said, looking at me quizzically, "but I'm the only one in this town who is!"

This, uttered in a tone hollow and as if coming from far away, was enough to add new terror to my already shaken mind. I edged away from him. He noticed my movement.

"I'm harmless enough," he chuckled, then suddenly becoming serious he added, "but you won't find another human being in this whole city. I helped to kill some and the rest just left!"

"A lunatic! What next?" I thought, and summoned my returning strength in case he should spring. He was too uncomfortably close!

"Aw, I'm not crazy," the old fellow said, reading my eyes, "though Heaven knows I've had enough to make me so! I'm the brother of Sanford Lewis . . . the inventor . . . you know . . "

"So you're his brother!" I had heard it was best to humor the demented.

"Yes. He was the only one of us who ever made a name for himself. You see we came from an old pioneer family of this city and my brother took such a great pride in it that all his inventions were toward its betterment and progress. I expect you've heard the motto, 'The best in the west'?"

"Oh, yes."

"'The best in the world' was my brother's slogan for this city. . . ."

"And of course he realized his ambition?" I asked, with a sarcastic smile toward the scene of devastation I had quitted in such a fright.

"No," he answered soberly, "he failed miserably. But he ain't to blame. He died in the attempt."

"That's too bad," I sympathized, for I really pitied the poor cracked fellow.

"Yes. He gave his life to his great idea."

"And what was that?"

"He aimed to make this a city without noise!"

"Without noise?" I asked, wondering where the old man's craziness was leading us.

"I mean without the terrible racket and thunder of its traffic. My brother tried to make this a city without noise. Think! Think, man, what success would have meant! People would have flocked to it! Every city in the world would have copied it. . . ."

"I should think that anything which would kill noise outside of buildings would kill it inside. Nobody would be able to hear themselves talk and you'd be as badly off as before," I objected with an arousing interest.

"That was the trouble. I don't pretend to understand these scientific things . . . wouldn't take any more'n a grammar school education . . . but my brother could have told you everything about his invention. He used to make himself so clear that even an ignoramous like myself could see what he was driving at . . . and then five minutes after he was through I couldn't tell you what he said My family were all patient with my —my stupidity —but just the same it was me that caused that . . . " and he stretched his hands towards the dead

city. His voice was casual enough but I noticed a peculiar twitch of his whole body, as if all his nerves suddenly contracted and then relaxed. Whatever terrible thing had happened, he had evidently trained his mind to review it dispassionately but his inner self could not be trained to look back without a quiver. At first I thought it would be unkind to resurrect the past for him, even though I was dying to know just what happened. Then it occurred to me that lonely people sometimes find relief in talking about their troubles, so I led him on.

"CAN you remember," I questioned, "how your brother overcame his great difficulty in making a noiseless city?"

"Yes, I can remember that. It appears to me his air fluid was supposed to kill all sound produced by metal but not that produced by the human voice. Yes, I know all sound is just waves of air. But there are different qualities of sound, aren't there? Well, this fluid of his was of such a subtle nature that it neutralized and balked only the waves which were caused by the ring of metal. At least, that's what he claimed. I saw several demonstrations that seemed to me to prove he had succeeded. Why, I saw the demonstration that convinced the city council that he had a great thing and induced them to let him try an experiment on the air of the city itself. I can tell you it was a long, hard pull to bring those autocrats of the city hall to that state of mind. But one day a moving picture magnate came here from Hollywood. He had read in a scientific journal of my brother's invention—one of the scientists at work on his sound pictures had seen it. This moving picture man—I forget his name—offered to move his entire studio here if the sound-killing device of my brother's proved successful. He said that other companies would follow if they were sure of finding a place where they could make sound pictures without the danger of outside sound interference. That prospect is what moved the city council to give my brother a trial. They even hoped to make this a second Hollywood."

"How did you go about a demonstration of this sort?" I asked, beginning to see the bearings of his story.

"With a band and speeches," he smiled down into that funny little white beard of his. "The night my brother came home and told me the mayor was going to let him try his experiment on the city I didn't sleep a wink all night. Neither of us did. I was terribly worried, for I was to operate the projection machine from the roof of the City Hall." He raised a shaky finger to the one skyscraper outlined against the setting sun. "On that roof from which the central tower springs the machine was to be installed. It's the highest point in the city. I can tell you I was nervous!"

"Why didn't your brother control the machine himself?" I asked, to draw him from his reverie.

"He had to be across the street in the City Hall Square with the rest of the celebrities to see how things turned out. He did his best to help me, though. He explained the workings to me a dozen times. It didn't seem humanly possible to make a mistake. But I was scared and didn't take in half of what he said. He left and I waited for my cue to turn on the substance that was to work miracles. My cue was the sound of the brass band playing the 'Star Spangled Banner.' When they got to that part where it says 'bombs bursting in air' . . . you know . . . well, I was to work the magic. I was so nervous I hardly recognized the tune when it came. And in the end I just turned it on any old place in the music. I did it for him . . . my brother . . . I meant only the best for the city . . . I turned it on!"

"What happened? You stop in the worst places! What happened when you turned it on?" I urged.

"Nothing!" He spoke as one coming out of a dream. "Nothing except silence . . . dead silence!"

"What did you do?"

"I waited for I hardly knew what. At last I went to the parapet and looked over. . . ."

"Well? What did you see?"

"I saw hell . . . a silent hell! The street was thick with people. All up and down as far as I could see the buildings were emptying just as they do after a heavy earthquake. Seems like folks had the terrified feeling that goes with a great calamity and wanted to get clear of the buildings . . . out in the open. And they did the worst thing they could do. They stampeded toward the City Hall Square. Directly below me they swarmed in a great eddying mass, like a silent whirlpool. Two street cars, not being able to hear warning bells, collided and made a sort of snag in the rushing torrent. People kept running out to help those already injured and getting knocked down themselves . . . automobiles smashed here and there, injuring more . . . everywhere lay men and women and children injured or dying without audible cries or groans . . . it was ghastly . . . like a motion picture of warfare . . . I don't think about it any more . . . it would drive me crazy!"

I respected his silence for some time and then asked gently, "The experiment was unsuccessful?"

"Well . . . it killed all sound within a radius of a mile . . . all sound . . . caused by metal or anything else. You notice our voices sound kind'a hollow. Well, we're on the rim of it. It is getting faint here. But you couldn't hear a cannon shot in the city itself!"

"Why didn't you turn the infernal machine off when you saw what it was doing?" I offered.

"That's the terrible part! I couldn't!" and I saw tears in his pale blue eyes. "I tried . . . oh, how I tried . . but I forgot how. . . ."

"Why didn't you get your brother to come and turn it off?"

"I tried to. I beckoned to him like fury. I could see his tall black silk hat in the crowd milling around the band stand. He pushed through the crowd there and came running across the open space. He was waving his hand and looking up at me. In the middle of the street an automobile hit him . . . he couldn't hear it you see . . . he died instantly. . . ."

For a long time we sat there in silence looking out upon the city over which the sun had set.

"And so it was never turned off?" I really knew without asking.

"It was never turned off! I couldn't remember what my brother had said even when I was calm again several days afterward. I tried until I thought I would go mad. But it was no use."

"Why didn't you take the machine away and junk it?" I asked hopefully.

"No use! Once that stuff was on the air nothing would do any good except to neutralize it. And my brother was the only one who could do that . . . and he was gone. No, there was nothing we could do. People

(*Continued on page* 180)

Madness *of the*

By R. F. Starzl

Author of "Out of the Sub-Universe"

FOR the benefit of those of our readers who are skeptical about the efficacy of surgery by radio, we reprint extracts from a newspaper notice which appeared in the "New York Times" of December 21st last:

". . . Captain Thoraldson of the Norwegian freighter Tela repaired the fractured skull of a deckhand with a large rigging needle while the ship was hundreds of miles off the Delaware Capes in a rolling sea. The deckhand was in good condition when he arrived at the port of Philadelphia. . . . The only part which the medical profession played in the matter was a diagnosis by radio. Captain Thoraldson gave a ship's doctor several hundred miles away a description of the injuries and asked for instructions. Back they came; out came the rigging needle, and the job was done. . . ."

The extract reads almost like the description in "Madness of the Dust." Yet this story was written some time ago.

Illustrated by WESSO

JOHN FARRINGTON looked out of a metal-ringed, thick glass window at a hopeless red landscape, unrelieved by mountain or lake or tree. No sign of water, because the nearest of the great twenty-mile-wide but shallow canals was over a hundred miles away. No sight of blue sky, but a vague reddish void that on rare days darkened to a purplish black, where sometimes the brightest of the stars could be seen hours before the setting of the small but fiercely brilliant sun.

The sun was not fiercely brilliant now. High overhead it rode, but it was only a blob of red in a red sky, and ever higher whirled the clouds of red dust, driven by the fierce autumn winds of Mars. Endless tall, whirling columns of dust walked across the desert's face. Broad, viciously driven lines of dust swept over the horizon and hurled themselves upon the lonely trading post, as if they would demolish it and scatter the aluminum sections far and wide, but the shock of the wind's onslaught was light. Lacking the weight of a dense atmosphere, the Martian storm, for all of its violence, was feeble compared to terrestrial standards. It failed to halt the labors of the natives, who continued to pile bags of borium, a powerful catalytic agent then much in demand on Earth, on the loading platform as fast as it was received from the underground refineries, which extracted the borium direct from the ore body. Grotesquely magnified by the light and shadow distortion of the haze, they plodded stolidly about their tasks in the gathering murk. Occasionally one of them came close enough to the window for Farrington to see the dust on fat, blubbery scales covering arms, legs and back.

There was an apologetic drumming noise in the room behind the trader. It was Nasa. She stood uncertainly beside the double door through which she had let herself in—herself and a blast of cold. A dry cold—almost the cold of waterless space.

"What is it, Nasa?" the man asked sharply.

She looked at him with the saucer of her great, single eye from which the dust-protective lids were settling away in transparent folds. In a few moments the drumlike membrane of her chest inflated, and from it came sounds—sounds that had startled the terrestrial discoverer, a Miss Columbine, back in 1992. To Farrington the sounds conveyed meaning. Nasa was speaking in the bastard dialect used by the laboring classes of Mars.

"Get your ugly face out of here!" he shouted. "I'll call you when I want you to clean up."

She turned placidly to go, gentle, uncomplaining slave that she was. Farrington was stricken with quick compunction. He called her back and handed her an

Dust

With superhuman strength he was struggling with Nasa, struggling to break away and vent his fury—

orange—that strange and luscious fruit, which, above all other importations from the succulent Earth, the Martians craved. Nasa pounced upon the gift, tossed it into her huge, purple-splotched maw, and with many gurgles and snorts of delight she savored its lush sweetness, let the juices trickle slowly and deliciously down her gullet, the while she boomed and purred from her drum-head diaphragm.

"I don't know what's getting into me," Farrington thought. "I'm getting crankier every day. It's lucky those fellows are so good-natured. When I heaved a rock at old Nua yesterday, he just let it bounce off and snored. He could have broken me in two with those steam shovel claws of his."

He put his hands to his temples. "Wonder what's the matter anyway. My head feels like I had a hoop of steel around it. I can't eat; I can't sleep. My eyes feel like they're burning."

He drew a large glass of water from the tank in the corner of the room and gulped it down. He refilled the glass and drank again. Although he filled himself to repletion, he could not slake the thirst that constantly consumed him. Suddenly he dropped the glass and it broke on the stone floor—the second that day. Dizzily he lurched to his cot. He tossed about on it, but soon he dropped off to sleep. When he awoke it was almost night. The wind was gone and stars were brilliant in the purplish black heavens. The Martian laborers had left—gone to their mysterious sub-martian caves, where they lived their half-reptilian lives.

"Don't know what I'm going to do if those spells keep up," said the trader to himself soberly. "Maybe I'd better ask for relief."

The thought galled him. He remembered the eagerness with which he had asked for this post—the most dangerous of all the colonizing points in the far-flung solar system. It had been quickly discovered that the atmosphere of Mars was insidiously hostile to terrestrial life. In the early days many a colonist had been returned, writhing in the throes of a strange madness—a madness in which they babbled of The Dust—The Dust. A madness in which they sought to harm those dear to them.

Farrington had only laughed when Ellsmore, Old Ellsmore, head of the Planetary Civil Service, warned him of the dangers at the Borium post:

"It's got some mighty good men, and not all of them recovered," Old Ellsmore said seriously. "Of course the salary is high on the Martian job, but when you consider the hazards it's not so much. They have to pay a high salary to get a white man to take the job at all. Why not let me fix you out with a nice post on Venus? The City of the Caverns is becoming quite a health resort, and you meet no end of smart people there."

"No," the young engineer said positively. "I don't care to loll around with a lot of professional travelers on a steam-heated planet. Venus is too hot for a white man to get ahead on. Besides, you know how every pimply-faced clerk on Earth wants to be sent to Venus, and the salaries are accordingly. I couldn't marry Alfreda on the salary they pay."

"Don't worry about that, my dear Jack," smiled Ellsmore. "You know that the man who marries my daughter never has to worry about money. I'll——"

"Well, if *I* do, I *will!*" Farrington interrupted. "Unless I can make a stake I won't feel right about marrying anybody. I want the Borium post. I know I'll be able to fill my quota, and with the bonus it'll bring me, I'll be able to offer Alfreda a safe future."

"I admire your spirit," said Ellsmore sadly. "I hope you hold out long enough to get back safe. Well, go ahead and get ready to start."

Farrington smiled wearily at the quixotic spirit of his youth. His youth! Why, that was only six months ago, Earth time. Just six months, and he was still young. Only twenty-five, but it seemed more. Well, he'd give something to be on that Turkish bath of a Venus right now, or better yet at a certain bend of a sandy creek back home in Texas.

IT occurred to him that in six months his schedule called for completion of his quota. He pressed one of a row of buttons on his working desk. Hardly a minute later a trapdoor opened, and one of the Martian checkers climbed up. He was a youngster himself, and patently uneasy.

"Weight. Weight slips—got 'em?" Farrington addressed him eagerly.

The diaphragm tensed, snored placatively. Quickly the creature produced the receipts printed by automatic weighing machines, giving the total for each day. The machines were specially designed to give Earth weights on Mars.

With a joyful thrill Farrington read the figures—127 tons. His quota was only 120 tons. On the instant his mood changed. He felt again the pressure on his temples, the burning in his eyes. He saw the interior of the room through a red haze—red dust.

"Why didn't you tell me?" he roared. He leaped upon the astonished Martian, beat the unresisting creature harmlessly upon its leathery, blubber-filled scales. The protesting, wheedling noises from the diaphragm only increased his rage. He pounded the vocal apparatus of the Martian with his fists until the room was filled as by the low booming of thunder. And then of a sudden the room was alive with Martians. Anxiously, clumsily they picked the frantic Terrestrial from his victim and carried the latter to bed. Conscious of their helpless concern, Farrington was filled with hate for them, kicked futilely at their ugly, kindly faces. He hated them for their ugliness, their low organization. He hated them for their rank, oily odor. He hated also those aristocratic ruling Martians, lolling idly in their polished cities near the canals, living on the work and the brains of ancestors centuries ago dead, condescending to trade with the young, brash planet to sunward only for the sake of their palates. He hated their insolence in refusing direct contact with the Terrestrials, transacting all business through their slaves. He hated . . .

He found that he hated everybody—himself, old Ellsmore, Alfreda even. No, he didn't hate her, but he hated . . . God! For the strength to kill these beasts!

Water was pressed to his lips. He drank greedily, in long, deep draughts. When the glass was empty he mouthed for more. It was given to him. He lay exhausted. Gradually he drifted to sleep. The last sound he heard was the rustling whispers of his nurses. His last thought was:

"It's got me! It's got me! The Dust Madness has got me!"

When he awoke again it was still night, and the long, single room of the trading building was dimly lighted by the mellow glow of a single ion tube. The natives were all gone except Nasa who, mournfully regarding him, sat on the floor. His head was reasonably clear again, but he dared not move for fear of bringing on another fit of rage before he could do what had to be done. He caught Nasa's eye.

"Lift me—" he commanded guardedly, "lift me to radio!" He shut his eyes again. She lifted him, cot and all, set him down before the simple panel of the automatic transmitter. He reached for a central dial, turned it to the call of his operating base in Brazil. Overhead there was a subdued grinding as the astronomically corrected directional antenna turned to the proper position. A bell tinkled musically, a signal that the carrier wave was going out.

"Hello Rio! Hello! Hello Rio!" he said in ordinary conversational tones. He did not wait for a reply, knowing that minutes must pass before his message could reach the Earth, and minutes more before the answer, speeding at the rate of over 186,000 miles a second, could come back to him. So he gave the whole of his message at one time:

"This is John Farrington, Planetary Civil Service 4B1189, stationed at Borium post, Mars, reporting. We have completed our quota of 120 tons and are ready for relief. Include in next trade shipment 100 cases of cantaloupes and 40 barrels extracted honey. Protect shipment in forward holds better against interstellar cold—the food commissioner here is complaining. Please hurry relief. We have storms every day; the dust is bad. For God's sake hurry, before I go clear crazy!"

Almost instantly there came a reply from the resonant, slightly luminous globe above the panel:

"Buck up, Jack old boy! I'll be with you by daylight. I've been on the way a month, and I'll soon be dodging your dinky little moons. The old ball certainly is dusty; I couldn't see any of the canals or other markings for days on account of the dust."

"Is it you, Steve?" exclaimed the sick man. "By Glory! It is! Boy, Steve, I'm sure glad you're coming —you're sure the best friend I've got."

"Best friend, I hope, and most persistent rival. Fact is, old boy, I came here because Alfreda insisted. She was worried by some of your queer messages. She sent *me*, you understand, who have papers entitling me to command the finest Venerian liners, to take a rickety old hulk to this miserable hole and bring you home. That's what hopeless love will do to a man!"

Farrington put his hands to his temples. They were throbbing again. With quick, nervous movements he kicked the covers off him. With an enormous effort of will-power he tried to keep his voice from shaking. He said levelly:

"Yes, I guess you're persistent all right. I guess you know when to take advantage of a man, when he's killing himself to make a home for a woman. I guess I can see you, those long months that I spent in this hell, hanging around her and turning her silly head with your sympathy——" The pressure in his temples was splitting his head——"When I'm able to get up again—I'll tear you——"

"DONG-NG-NG-NG!"

It was the beginning of the Rio answering message.

"Reply to Borium post: Relief ship has already been sent and at last report was 200,000 miles from Mars. It should be in path of directional radio beam. Ship carries freshly made specific for Dust Madness. Freighter will stop on return from Uranus and load borium. Regarding complaint of frostbitten fruit, Captain Skoglund reported——"

The voice droned on, but Farrington did not hear. With superhuman strength he was struggling with Nasa, struggling to break away and vent his fury; to vent his fury on anything—the delicate instruments ranged around the room, for instance, in lieu of that still unreachable friend whom his madness pictured as a betrayer. He subsided finally amid sobs, accompanied by gulping noises of sympathy from Nasa as she plied him with water.

JOHN FARRINGTON sat in the half darkness of the old dispatch ship's white-painted hospital room. Through small ports of six-inch thick glass he could catch a glimpse of the black sky with its great, steadily glowing stars. The faintly luminous wake of the atomic rockets, fastened at various points on the ship's hull, trailed past the window and off into infinity. Unquestionably the old space ship was making its best possible speed toward the Earth. Steve had mentioned that they were past the half-way point and that soon the rocket tubes would be reversed. They were darting in a grand diagonal to a point of the Earth's orbit, mathematically determined, that would bring the ship to its base near the mouth of the Amazon river.

Farrington felt much better. He had only a vague recollection of having been carried, screaming and fighting, by some of the motley crew in Steve's command. The Martians could not be induced to even approach the ship. They had an overpowering dread of leaving their planet, ever since the disastrous expedition of the year 2025, when hundreds of them, having been induced to embark for Earth, died of tuberculosis in the humid, dense atmosphere so foreign to them.

The specific had again proved its worth. In conjunction with the constantly purified air of the ship it had allayed almost completely the dreadful attacks of homicidal mania which was for many years to prove an almost insuperable barrier to the permanent colonization of Mars.

The door opened and Steve came in.

"How's the patient this morning?" he smiled cheerily. "You look a little peakish, but you're getting back some healthy color just the same."

"I feel fine, Steve. It doesn't seem possible now that I was so wild a couple of weeks ago. It seems like a dream."

"It was certainly a wild dream. I got a laugh out of your checker. You gave him such a beating on his diaphragm that he could hardly talk. He wasn't sore, though. You certainly put yourself in solid with the Martian work-hogs before the dust madness got you."

"I hope you'll forget about the way I acted, Steve."

"It's all forgotten. It's all over, in fact. You've slept it off. I've used up all the specific, but I don't think you'll need any more. Just drink plenty of water; get the poison out of your system."

"It was awful while it lasted. You've saved my life in more ways than one, Steve. You've treated me as well as any doctor."

"It was that or nothing. They don't send out sur-

geons on these old tubs. If it wasn't that the underwriters insist upon it, they probably wouldn't even equip us with radio."

They discussed the niggardly policies of the ship owners at length and with considerable warmth. Steve talked of the destruction of a planetoid that had been a peril to shipping, and after they had taken a meal they repaired to one of the empty storage holds that was temporarily fitted up for a gymnasium.

"I'm not so good today," said Steve. "My side kind of hurts, but a good work-out might help it."

They put on the gloves, and for ten minutes there was no talk; just the swift thudding of padded fists, the rapid shuffle of feet, and soon, the panting of breaths.

All at once Steve sat down, and his face was pale. He held his hand to his abdomen.

"Sorry! Sorry, old man! I didn't mean to foul you!" Farrington bent over his friend.

"You didn't foul me, Jack. You never touched me, but my belly sure is getting sensitive. It hurts like it was going to split open." His abdomen was in fact distended and the muscles were tense and hard.

"I guess it's the old appendicitis again," groaned Steve. "It's been bothering me, off and on, for years."

"Let me help you to the hospital cabin. You can sleep in my bed for a while."

"No—ouch! Not yet, anyway! Just let me sit here for a while. It'll get better soon."

But it didn't get better. A half hour later Farrington telephoned to the crew's quarters for help. Two Levantine roustabouts responded and carried the pale and perspiring shipmaster to the hospital. They were unprepossessing fellows, graduates of rough experiences on more than one remote planet.

"You'll have to take charge," Steve said feebly. "You needn't bother about navigation. Krassin and Boloman can handle the instruments all right, and they have their orders. But I guess you'll have to kind of watch me. I guess—I'm afraid—I'm going to—pass out. Alfie—Alfie, hold my hand!"

He was in a raging fever. His abdomen was still distended. His heart thudded terrifyingly.

FARRINGTON rushed to the adjoining radio room. Dialing the Rio station, he demanded preference over all other messages. Without waiting for acknowledgment he recited the symptoms of the shipmaster's attack, closing with a desperate appeal for help. Quickly he unplugged the transmitting and receiving units, and by means of extension cords, set them up again by the bedside of the sick man.

"DONG-NG-NG-NG!"

"Rio station replying to Interplanetary L-4. Dr. Camelard has been called from the infirmary and he already has a printed copy of your message. He will advise you what to do."

A few seconds later the doctor spoke:

"Most likely your patient is suffering from a ruptured appendix. You're lucky if he doesn't get general peritonitis. It's a hell of a note to send out a man with a chronic case like his on a ship full of bums and an invalid. Just the same you're going to save him if it possibly can be done.

"Look around and see if you can locate the standard surgical equipment chest. It'd better be there or some inspector is going to be in trouble. Open the wall cabinets until you find the steam sterilizer. Turn on the power, but don't forget to see that there's water in the boiler.

"While I'm talking to you you can wash your hands. For surgery your hands have to be not only washed, but *scrubbed*. Don't mind if you take off a little hide. Get them *clean*. Then you can rub 'em good with the bichloride of mercury. Fix it double strength. Open a tube of catgut, but don't take it out of the liquid until you need it."

The doctor paused to ascertain if Farrington was following him. In a few minutes he continued:

"Put one of the morphine tablets in his mouth now so he'll be ready when you are. Since you can't perform an operation without assistance, and keep your hands sterile, keep a bowl of chlormercoxol handy. Wash your hands in it every little while as you work.

"You won't need many instruments. Pick out a good sharp scalpel. Find one with a 45 degree blade. Take a couple of forceps and one or two good heavy retracters. You may not need a hemostat, because you're not going to take that man's appendix out. The shape he's in I would hardly dare try that even here. All you've got to do is to make an incision and put in an inch drainage tube. Understand that, just put in a drainage tube to let out the pus, and if you don't get in a lot of dirt, he'll probably recover."

On and on came the matter-of-fact directions. The doctor took each point separately, painstakingly instructing. Occasionally he paused to give Farrington a chance to ask questions. He told him how to locate the right spot, half-way between the navel and a point on the right hip; told him to shave the drum-tight skin; to wash it with the chlormercoxol, most deadly of all germicides, which would even penetrate tissues to destroy lurking unfriendly organisms.

AND all that time Steve lay in shallow but persistent anesthesia. And all that time he babbled of Alfie—Alfreda. He thought she was standing beside him—denying him—denying him the kiss that he yearned for more than all other kisses that were available to a handsome young master of Interplanetary Liners. His hallucinations shifted to the Caribbean. In a hydroplane they were skimming the crests of the dancing waves. She was smiling at him——

"Alfie—Alfie—I love you!"

Beads of sweat stood on Farrington's forehead. He was physically tired. He felt a nausea usually associated with space sickness, though the decelerating effect of the atomic rockets provided a very acceptable substitute for the steadying pull of gravity. If he could only sleep a little! But there lay his friend, utterly helpless. But *was* he his friend? He looked at the partly unclothed form narrowly. Certainly a magnificent body. Certainly a handsome head. Wonder if Alfreda thought so? The pressure of his temples was back. Not so bad, though. He drank deeply, a couple of pints of water.

What was that! Not too far? "Be careful not to go too deeply," the ether-borne voice was saying. "Remember, you have a man's life in your hands.

"First you cut through the skin and fat. It won't bleed much. Next you come to the fascia. It's a sort of white, thick skin covering the muscles. Cut through it and you see the muscle. You can split that and won't

need to cut much. Just take the handle of a scalpel and separate the fibers. Then you're clear down to the peritoneum, and it's ticklish work for an amateur. You'll find a thin tough membrane investing the viscera. Go very easy in cutting through. A slip of your knife and you might puncture an intestine and your man's done for, with all of the pus and corruption in the cavity. This is the way to do it: You take a little fold of the peritoneum with your fine forceps——"

On and on, endlessly. The room was oppressively silent. That steady pressure on his temples! His eyes burned. Oh, how he longed to rest! "A slip of the knife and he's done for!" Farrington battled against the horrible thought that dogged him. "Just a little slip of the knife" and Steve would stop moaning, "Alfie—Alfie, hold me!"

Forward, in their own quarters, were men. Stupid and brutal, to be sure, except for two busy navigators, but men. Farrington toyed with the thought of bringing one of them up, not to perform the operation, but to watch him—Farrington. He laughed. How could they know? How could anyone know? Just a little slip of the knife; just a little slip, and those restless tossings would soon be stilled. Besides, it wouldn't do to let the men know the seriousness of the situation. Mutiny under such conditions was not impossible. The sweeping voids of space still offered rich possibilities to pirates who were hearty and bold.

"I can't do it! I can't do it!" Farrington cried aloud. "Just one little slip and I'll kill him!"

" . . . having removed the most of the pus," went on the voice, unperturbed, "notice the color of the intestines. If they are red, inflamed, as if they had been scalded; if the veins are congested, we may safely assume——"

There came a shriek. Farrington's despairing cry had gone over seventy-six million miles of space, and had been heard by one who sat in the Rio transmitting station in distracted silence. Her involuntary scream had been picked up and hurled back at the speed of light, and now re-echoed around the dingy cabin.

"Jack!" she sobbed. "Jack, you must! He saved your life, Jack. He saved your life for love of me. Don't fail me, Jack!"

"Take her out!" It was the voice of Dr. Camelard to an assistant.

"Of course you're going to make a success of this, Farrington," he resumed testily. "If you fail, Alfreda will never speak to you again. She has sat here in torture for a long, weary hour. Take hold of yourself, Farrington!"

"Alfie! Alfie!" gasped the sick man.

" . . . the idea is to insert the tube so that it will permit free drainage—I would give him another morphine tablet now, Farrington—free drainage will permit nature to take care of the trouble. The ruptured appendix may heal, or at any rate he will be tided over until we can operate on him at the hospital here with the high-frequency apparatus, which will be perfectly safe. The thing to do is to keep him alive until then. See that the tube is well in past the peritoneum, and that it isn't obstructed. You sew the flap up as far as possible and put a stitch through the tube to hold it in place.

"Now, then, we're ready to start!"

Farrington seized a scalpel. The iron band around his head was intolerably tight. His eyes burned. He saw the form before him, sometimes in gray light, sometimes in red haze—Red Dust. Hammers were clanging on iron in his brain. Two voices disputed between hammer-blows.

"No one will ever know," urged one. "A little slip, down in that pus and corruption—a little slip!" The voice was thinly eager. It was demoniacal; it was yearning. It hammered on his brain like a sledge on iron, with a bloodthirsty red eagerness—with a dry, cold eagerness. "Just a little slip—just a tiny little slip!"

"He is your friend!" insisted the other voice. It was a warm voice, and very, very weary. "He saved your life. He was sick, but he came to get you in this old tub because there was nobody else available. He could be comfortable and safe if he'd stayed home, but he came even before you asked for help, because he thought you might die if he didn't."

"Your friend!" mocked the sneering red voice. "While you were slaving in that hell-hole for the sake of a woman, he was winning her from you. Your friend! Fool! Don't you know he came because of her, not you?"

"If she loves him," insisted the other voice, still patient, wearier still, "there are plenty of other women. And if you love her, why kill him? After all, he saved you, no matter what his motives. And if you love her, save him for her!"

"The first incision," came the message, "should be practically vertical. Hold the skin firmly between two fingers, stretching it if not already tight——"

Farrington began.

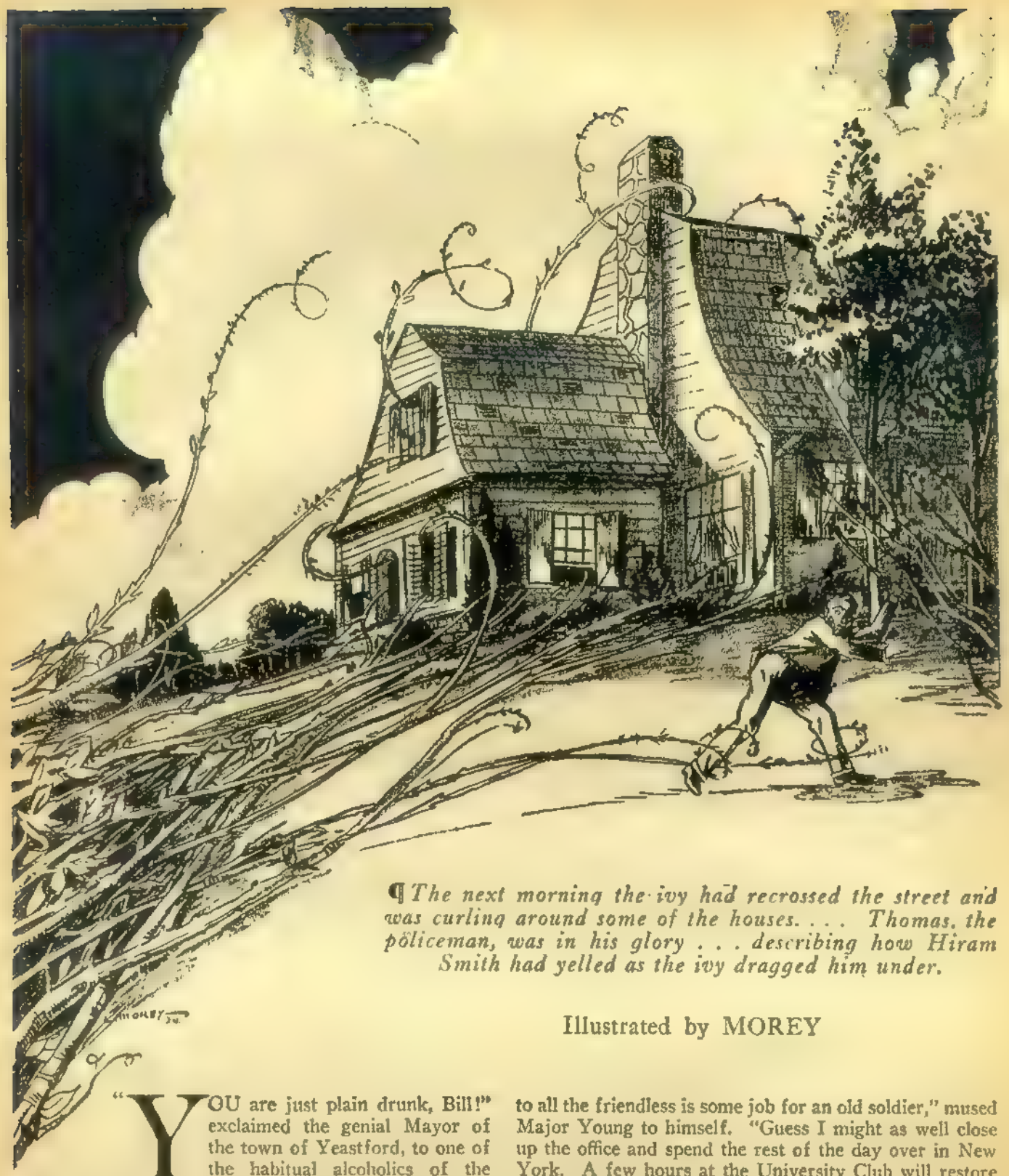
THE L-4 settled smoothly in the mooring pit at Rio. A dirty looking mechanic in fatigue uniform unscrewed the bolts holding the door tight to the tall, cylindrical sides. Through the thick glass his head could be seen bobbing up and down as he wound at the heavy screws. With a rasping of corroded hinges the vacuum door swung open. A collapsible gangway slid automatically to the edge of the pit.

The little group at the pit peered anxiously into the semi-darkness of the interior. An elevator descended clicking. Farrington came to the door. He was deathly pale. He walked slackly. He stood aside and motioned with his hand.

Four hospital orderlies quickly entered the ship. They stepped into the elevator with Farrington. There was a long wait. More mechanics came out, squirming over the pitted surfaces of the ship by means of handholds placed at convenient intervals. They connected lines of air-hose to the tank leads, coupled water pipes, replenished the atomic cartridges, replaced the badly worn nozzles of the rockets with new ones of artificially crystallized carbon. Boxes and barrels of air-conditioning chemicals were trucked into the ship. Tons of vitiated chemicals cascaded through vents into the reworking hoppers below. It was a scene of cheerful bustle and activity, such as occurred daily at numerous space-ports everywhere on the inhabitable planets of the solar system, but to the little group on the platform it was a scene of dread. They saw that dark door of uncertainty. They awaited the clicking of the elevator.

It came. Almost instantly the four orderlies were in the door. They carried a stretcher. On it was Steve. He was grinning jovially and waved gaily to his friends.

(*Continued on page* 181)



¶ The next morning the ivy had recrossed the street and was curling around some of the houses. . . . Thomas, the policeman, was in his glory . . . describing how Hiram Smith had yelled as the ivy dragged him under.

Illustrated by MOREY

"YOU are just plain drunk, Bill!" exclaimed the genial Mayor of the town of Yeastford, to one of the habitual alcoholics of the vicinity. "Just a little too much this time, or you would not be talking such nonsense. Go home and to bed and you will feel differently about it tomorrow, and laugh at yourself when your dog comes back from his hunt."

"I am drunk!" admitted William Coonel, "but anyone would get drunk after seeing what I saw. You go down to the old swamphole yourself and see how your nerves are afterward. Go on, Major Young, and then tell me whether I am drunk or not." He staggered out of the office, leaving the Mayor smiling at his persistency.

"This job of being Mayor of a small town and friend to all the friendless is some job for an old soldier," mused Major Young to himself. "Guess I might as well close up the office and spend the rest of the day over in New York. A few hours at the University Club will restore my cosmopolitan viewpoint of life."

Two hours later he walked into the reading-room of the Club, just in time to hear hearty gales of laughter coming from a closely clustered group of men. When the laughter ceased, he heard a determined voice.

"In spite of your laughter," it said, "I want to repeat what I said. *The next great war will be waged between the human race and some form of plant life, rather than between different nations of humanity.*"

"You mean bally little smellers, like roses and violets?" asked a man in uniform. He was Captain Llewellen, at the present assigned to duty with the British Consul.

The IVY WAR

By David H. Keller, M.D.

Author of "The Seventh Generation," "Eternal Professors," etc.

DR. KELLER, being first of all a psychologist, is most interested in human behavior under given conditions—that is, human reaction. But he is also concerned with possibilities in various fields of science. Taking botany, for instance, it has been established some time ago that there are such things in existence as flesh-eating plants and other malignant flowers. We of the modern civilization have become quite smug in our feeling of safety from these dangers, that we know are considerably removed from civilized habitation. But what is there to prevent the successful transfer of such a dangerous plant, let us say, by some frustrated botanist bent on revenge? Here is a scientific fiction story that is interesting, entertaining and plausible.

"That is what I mean," answered the first speaker.

Elbowing his way through the circle of amused listeners, Jerkens, free lance reporter of a dozen wars, reached the center of the crowd, and holding up his hands, demanded silence.

"I want to report that war," he cried. "What headlines I could produce! How about this for the front page?

"Five Divisions of Infantry in New Mexico Surrounded by the Cactus Enemy. One Thousand Tanks Ordered to Their Relief . . . Heavy Casualties in Maryland. Our Troops Gassed by Lily-of-the-Valley and Tuberose Enemy Battalions. Generals Orchid and Gardenia Captured. They Admit That Their Morning Glory Division Was Wiped Out by Our Labor Battalions, Armed with Hoes. Patriotic Women Forming Regiments to Fight Violets and Roses. They Will Furnish Their Own Scissors. Golden Rods Massing to Attack Hay Fever Regiments."

And then the fun started and the laughter became too much for some of the older members of the Club who demanded silence. Soon the atmosphere of the place became normal. White, the plant biologist, who had been the butt of the fun, kept on smiling. But two strangers at once demanded his attention.

One handed him a card, saying, "I am Milligan, the explorer. I came across the ocean to see you."

"And I am just Mayor Young of Yeastford. I am a charter member of this Club."

"I do not know which of you I am the most pleased to meet," declared White. "Milligan has always been a hero of mine because he has gone to all the places in the world I have wanted to visit, while (and here he turned to the Mayor) if you are Major Young, of the Lost Battalion, let me tell you that when I was a boy I saw you play full-back on the Columbia team the year we defeated Pennsylvania. Ever since then you have been a hero to me." And he extended a hand to each of the men.

"Since all three of us seem to want to know each other better, suppose you take supper with me here at the Club?" proposed Major Young. "I will arrange a little room where we can be by ourselves and do all the talking we want to do. The boys were having a lot of fun at your expense, White."

"Yes, I was foolish enough to make a statement that was unusual and of course they all gave the ha-ha to me."

"And the peculiar part about it was that that statement was the very reason for my coming here from England to talk to Mr. White," said the explorer.

"Well, let's eat and talk," exclaimed the old football player.

Later on, in the little private room, Major Young started the conversation.

"Now, Mr. Milligan," he said, "suppose you tell us just what you want to find out from this famous scientist White. Yes, you need not object to that word famous, White. I have had a few minutes to myself and I looked you up and find that you have over twelve letters after your name and are considered the authority on plant life in America. You are as big a man in your laboratory as Milligan is in Gobi and Honduras. I looked you up also and find that you have written a dozen books about places that hardly any other white man has ever visited. So, here I am, just plain Charley Young, eating supper with two big men. Go ahead with your story, Milligan."

The Englishman took his cigarette and pushed its

lighted end carefully against the ash tray. When he spoke it was with slow, carefully selected words, beautifully pronounced,—as though he were dictating to his stenographer or addressing a gathering of scientists in London.

"In the course of my travels," he began, "I have been to a great many dead cities, great, ancient cities, that once swarmed with life. I have spent weeks in places like Angkor in Cambodia, once the home of a million Asiatics, but so completely forgotten, that none knew of its existence till the Frenchman Mouhot stumbled upon it in his quest for Asiatic butterflies.

"And down in Honduras I have seen the Mayan cities silently pass the centuries in the jungles; they thrust through the green forest the white marbled crests of their pyramidal temples. I have lived in those dead cities, places like Lubaantum and Benque Viejo. In all those places I asked myself the same questions: Why did they die? What killed them? In some places it seemed as though the inhabitants simply decided to migrate. But why?

"THE more I asked myself that question, the more puzzled I was. I saw something in Cambodia, and to my surprise, I saw the same thing in Central America. It was something that I thought I was sure of but it was so fantastic, so utterly weird and impossible, that I could not trust myself to put it into words. I am not like our friend White. I do not like to be laughed at. So I kept it to myself. Then, back in dear old England, I ran across the same thing; and at the same time I heard about the great work that was being done with plants by an American named White; so, here I am."

"What was it you saw in England?" asked the biologist.

"It happened when I went down to see my friend, Martin Conway. He had inherited a nice old house and a lot of money; so, he made up his mind to restore the place and live there. It was Allington Castle, near Maidstone. It might have been a nice place for him to live in, but the ivy made him stop. That entire estate was full of ivy, and on the Castle walls the growth was from six to ten feet thick and had branches over six inches in diameter. It spread all through the woods. It climbed up the oak trees, one hundred feet into the air, and literally suffocated them with its dense foliage.

"The stuff was growing all over the Castle, inside and out. Conway put a hundred men to work and it grew faster than they could tear it loose and cut it to pieces. They worked a month, and when they came back from a holiday, it was hard to tell just what they had done. It was discouraging, to say the least.

"Conway took me over to see a ruined Castle about seven miles from the one he inherited. This other Castle had literally been torn to bits. The ivy had grown over the masonry, sending its roots into every little crack. Then it had grown up to the top of the building, forming a thick mat over every square foot of the wall. Once it reached the top, it started to pull, and the whole building just crumpled, overnight. When we saw it, Leybourne Castle was just a ruin, covered so completely with ivy that all anyone could see was simply a large mound of green.

"And what made matters all the worse, it seemed that nothing else could live where that ivy lived. The woods around Leybourne, years before, had been filled with the most beautiful wild flowers and shrubs, but they were all gone, and the little wild things, like rabbits and birds, were all gone too. That gave me room for thought. It made me see that right in England there might be as wonderful things to look into as there were in the Gobi Desert.

"Because it was not the lack of money that made Conway stop with his plans for the restoration of Allington Castle. He had the money and the ambition, but he could not get the men to work there any more. You see, three of them had taken too much liquor, and instead of going back home at the end of the day, they slept there all night, and when morning came and the Coroner and his jury, why laboring men just did not want to work there any more, and Conway had to stop. But it made him mad and he asked me to come down and visit him. I went over the entire problem with him, and it suddenly occurred to me that perhaps something like that had happened at Angkor and down in Honduras. In other words, the same horrible thought came to me, came back to my consciousness, no matter how hard I tried to ignore it. I am an explorer, not an expert on plants, so I came over here to America to see if White could help me solve the problem.

"Just talking about it makes me tremble. Think of that! I have, and I say it in explanation and not to boast, faced death in a dozen places and in as horrible ways as a man can face it, but when I think that there is a possibility that my suspicion is true, it makes me tremble. Look at that hand," and he held out his fingers to show them a fine tremor.

"That is all right," said Major Young, in almost a soothing manner— "The braver a man is, the more apt he is to feel afraid. It is not the feeling but the actions that count."

"You say that three men were killed?" asked White.

"Yes. I guess you could use that word. At least, they were dead when morning came."

"And they thought the ivy—was that the Coroner's verdict?"

"No. I do not know what he thought; of course he could not say that—not in so many words. But Conway told me how the bodies looked, and we decided to do a bit of experimenting. We drove an old cow into the woods where the ivy was the thickest and tied her to a tree.. Yes, we went in while the sun was shining, and the next day, when we went back, the cow was dead—and Conway—of course he was not a physician, but he said that the cow's body looked the same as the bodies of the three dead men.

"This all happened in a poorly settled part of England. You can drive miles without seeing a cottage, and the few people who used to live there left, and some of them in a hurry, and none of them talk very much about why they left, because they do not like to be laughed at."

"Just ivy—just common ivy?" asked White, leaning across the table, and pushing aside the plates of food. "You mean that it was just the ordinary ivy that grows as an ornament on old buildings?"

"No!" almost shouted Milligan, as he looked point blank into the eyes of the biologist. "If it had been, we would have understood. In the first place, it was big. Conway and I stumbled over branches that were over a foot in diameter, and those branches ran for miles through what had once been the woods. We never could be sure just where they started from. Every few feet the branches sent out lateral rootlets and coiling twining

tendrils, replaced every third leaf, but we never were sure that we found anything like a central root. We did find something, however, that made us think. All these big branches seemed to come from one place, and we never were able to get within a mile of that place. We located it rather accurately on our map and this is what we found.

"Ten years ago there was not a bit of ivy in those woods; but there was a large hole in the center of the forest. The maps called it a swamp-hole. It had always been there! Some of the old men told Conway about it. Tradition had it as the home of a large snake. Silly idea that. Now, here is what happened. I mean to say this is what I think happened. This new kind of ivy started to grow out of the swamp-hole. Where did it come from? Why, out of the hole. And in ten years' time it had captured seventy square miles of England. And here is the thing that makes me tremble. Nobody knows about it, and nobody is doing anything about it. Conway and I talked about that phase of it; and I came over here. How about it, White?"

BUT the biologist did not have an opportunity to answer the question then, because the Mayor of Yeastford suddenly galvanized into life, as he asked, "Were the leaves a peculiar combination of white and green? Did those tendrils wave around in the air? Do you think that they sucked the blood out of the cow?—and the three men? Did you find swamp-holes like that in Honduras?"

The explorer and the biologist looked at the ex-soldier in astonishment. At last White asked, "What are you driving at, Major?"

"Simply this. Up in the town, where I am the Mayor, we have a hole that we call the swamp-hole. And today noon a hunter came in and told me his dog had been killed down there. But he was drunk; so, I did not credit his story. But he said he saw something like a large vine come out of the hole and strangle the dog. Now do you two men suppose that the same kind of ivy is right here in America? We have a hole there at Yeastford and something is coming out of it. You said that you never saw the center of this plant, never were able to come near the real roots of it. Here is your chance. Suppose we go up to my town and go down into that hole?"

Milligan took another drink and then started to pull up his pants to the knees, and let down his stockings.

"Look at those legs," he said.

Livid scars encircled his limbs. Ugly ulcers, just healing, were scattered along the scarlet lines. Milligan smiled as he explained, "I fell down one day. Fortunately, Conway was able to stay on his feet, and he had an ax and cut me loose. I was in bed for days. I want to see your little pet vines in that hole in your old home town, Major, but I want to be very careful about how I go near them. What do you think about it, Mr. White? Any connection between Angkor and the English ivy?"

"There may be. The reason for the sudden desertion of those dead cities has been a puzzling one to scientists. Some say it was a change of climate, others diseases, carried by insects. Terrible wars might have been at the bottom. But suppose, just for the sake of argument, that near each large city there was a swamp-hole and out of this hole came some antediluvian form of plant life? Let us further suppose that this plant life was carnivorous. Fear might have then led to the desertion of the cities and violent, unreasonable panic depopulated them.

"Thousands of centuries ago life on this world was bizarre, weird and utterly terrible. Everything grew big. Earth worms twenty feet long and bats with a wing-spread of sixty feet. Ferns grew into trees, two hundred feet high. Animals grew a hundred feet from snout to tail. Then everything changed, and the big things died and gave place to little things and at present man, the King of the Earth, is a little soft thing under six feet tall. But the dreamers have told us their suspicion that in the out-places of the earth, under the ocean or in unexplored caverns, the giants of antiquity lie, silently sleeping, waiting for the time to come when they can once again rule as Lords of the Earth. Perhaps in these centuries of waiting they have developed characteristics that we have not even considered as possibilities. For example. *Can plants think? Can they plan and act according to any plan?* If they can, and I think that I can show you something very much like it in my plant laboratory, then what is to keep some form of plant life from deliberately making war on the human race? I made that statement in the reading-room today and they laughed at me. And I did not know then about Milligan and his legs. I think that we had better go with Major Young to Yeastford and see what he has to show us, and then—I want to go with Milligan back to England unless things start over here."

Milligan, the iron man, the dauntless explorer of the waste places of the earth, looked at the biologist as though fascinated by his remarks. He had often faced danger, but it seemed as though he dreaded to face this thought. Yet, he forced himself to speak.

"That is what I thought," he said, "when I studied those dead cities. Something drove those people out. It came slowly, not like killing waves of animals or migratory invasions of savage tribes. It came slowly and the people deserted, while they still had time, and left the cities to the vegetable kingdom. Now a few monkeys sport furtively on the temple roofs of Angkor and a few parrots scream in Lubaantum, but they are afraid to venture too close or too near the ground. And the natives are afraid; they say the places are populated with demons, but in reality they will not be honest with you and tell you just what it is that they are afraid of. I feel that this threat from the ground drove those busy millions into an enforced exile, and it was so terrible, so horrible in its menacing frightfulness, that instinctively they decided to forget it, to blot the whole episode from the mental pictures of the history of their race.

"That is what I had in mind. And I could not tell anyone, because I was sure he would laugh at me. Then I saw a starting of it in England, and here in America I met a man who believes it possible and another man who says that he knows a place where a swamp-hole is just beginning to belch forth its guesome cargo. Suppose we go to Yeastford and study that hole? Perhaps then we will be able to see what can be done."

"And it will have to be done secretly and fast, because if it attacks our cities as it did in ages past or as it has that little part of England, then our civilization is doomed," cried White.

"Bosh!" cried the Major. "Bosh and fiddle-faddle! Nothing can destroy us. We are too great, too powerful, too highly intellectual."

The Yeastford Real Estate Company had known about

the Swamp-Hole when they bought the large area of land over in South Yeastford. They had been forced to buy the hole in order to secure the rest of the land. They knew when they bought it that they would never be able to sell it. It would never return a dollar of their investment to them; so, they simply charged up that acreage to profit and loss and added a little extra to the price of each building lot they sold.

THE town grew around the hole. A National Highway passed one side of it, a railroad another side, and two streets the remaining sides. Thus, the hole was surrounded on three sides by cement streets and on the remaining side by the tracks of the D. L. and W. R. R. A busy, happy and prosperous neighborhood of substantial folks lived there and passed the hole daily. They had become so accustomed to its being there that hardly any of them realized its presence.

From the stout fence that surrounded it on all sides the land fell rapidly down to a circular center. The pitch was so steep that it was difficult to descend to the bottom. And there was nothing there when the bottom was reached except a mud hole, ice in winter, dry in summer and a muddy pond after every hard rain. Trees grew on the steep sides, ferns and moss covered the ground, a few pond lilies tried to live in the stagnant water, their only visitors the myriad mosquitoes, their only friends the little frogs who sat shyly on the lily pads.

Birds flirted in the tree tops and gorged themselves in the fall on the wild grapes, while below a few rabbits and squirrels claimed ownership of the nuts that fell from the walnut and hickory-nut trees. Occasionally a dog would dash through the underbrush and in the fall a few hunters tried to kill the rabbits that had the temerity to live so close to civilization. That was the Swamp-Hole of South Yeastford.

The three men arrived at Yeastford about forty-eight hours after the hunter had lost his dog. They had decided that it would be best to keep the real reason for their triple visit a secret. So the Major simply told his housekeeper, that he had two political friends visiting him, and asked the inquisitive reporter to say nothing about the fact that the Mayor was entertaining company. Fortunately, the next day was dismally drizzling, making it possible for the three to reach the hole unobserved, climb over the fence and slide down the steep embankment without anyone's being the wiser.

In a few minutes, aided by the force of gravitation, they reached the mud hole at the bottom. Sure enough, there was the new growth of ivy and on one side was the dead fox-hound. He attracted as much attention as the ivy. The Major poked him with a stick and then gave his verdict.

"Dead as a doornail and dry as a piece of old leather."

"Looks like leather and bones to me," observed White.

"All the blood sucked out of him," whispered Milligan. "See those long white tendrils? They have suckers on them just like those on the arms of an octopus. They just wrapped around the poor cur and sucked him dry. See those branches move! I do not know whether you have noticed it, but since we have been standing here there has been a marked movement over in our direction. I worked on that point with rabbits for a while and the long tendrils seemed to be able to either see or feel or smell flesh. Let me show you. That is why I brought over this pole and the pound of liver. We will tie the liver to the pole and do some experimenting. Suppose we go around on the other side. Those long white arms are too close to me for comfort. There," and he held the liver high in the air over a part of the plant, "we will see how it acts."

They did not have to wait long. The plant slowly lifted its stems into the air and surely, with almost an uncanny, human precision, sent its tentacles towards the piece of liver suspended in the air. As the meat on the end of the pole was moved, the vine moved, following it. And at last, moving with a swiftness that surpassed the agility of the human arms holding the pole; the vine wrapped around the piece of meat and drew it down into the middle of the leaves.

"The leaves themselves," commented White, "are remarkably like the ordinary ivy except that they are white in spots. Were it not for those long tendrils, I would think that it was nothing exceptional. Of course, the fact that it eats meat is not unusual for the vegetable world—lots of plants eat meat."

"As far as I can tell," interrupted Milligan, "this is just the same kind of ivy we saw in England. At least it looks the same to me; the thing that frightened us was the largeness of it and the thought of where it was coming from and what would happen if it did not stop coming. Of course, over there we saw miles and miles of stems, while here there seem to be just a few yards."

"It must have just started here," explained the Major. "Just started. Fortunately, we found it in time. We must think of some way of stopping it—killing it—driving it back into the hole."

The three men made a queer spectacle as they stood there in the mist, talking about a danger that no one else in America realized. They were terribly in earnest, profoundly impressed with the immensity of the problem; and as they talked, the ivy grew towards them; grew towards them, especially Mayor Young, and silently sent a thin tendril up his trouser leg and wrapped around the ankle. He turned to go and fell, tripped by the vine. Other tendrils came toward him. White and Milligan pulled at him, took out their pocket knives and started to hack through the restraining bands. It seemed as though others came faster than they could be destroyed. At last the Major was free and the three men started to run up the hill as fast as they could.

And as fast as they went up the hill the ivy came after them. "Hell!" gasped White, shivering as he turned around for a minute. "It is up with us, and it's not growing. No plant could grow as fast as that! It is coming out of the hole. Hurry! HURRY!!"

He paused on a flat spot, seized a large stone and hurled it down the hill. The rock bounded into the air, was caught in flight by a dozen tendrils, played with in the air and then tossed aside as though inventoried as useless. And a minute later the three men reached the fence, climbed awkwardly over it and stood breathless on the cement walk. Major Young uncovered his legs and looked at them. They were bleeding from fifty small wounds.

Even as he bent over, a hand tapped his shoulder.

"You three men are under arrest for trespass," said the policeman. "Can't you see that there is a *'no hunting'* sign on that tree?"

Mayor Young stood erect and eyed the man coolly.

"I should think you would know me, Thomas?" he barked.

"Certainly he knows you," interrupted another man, none other than Hiram Jones, President of the Yeastford Real Estate Company. "Certainly he knows you, and so do I. You thought you were clever at that last election. You have tried for years to make a fool out of me, and now I am going to make one out of you. You three men are arrested for trespass. Tell your stories to the Magistrate. Go ahead, Thomas. I will make the necessary charges against them."

"But my dear man," expostulated Milligan, "you don't know——"

"Don't 'dear man' me," shouted Jones. "You talk like an English actor. I'll teach the three of you to hunt on my land!"

"It was the ivy we were after," explained White.

"It's something you ought to know about," added Milligan.

"If you do not believe me, look at my legs," pleaded the Major.

"The three of you are drunk. That is another charge, Thomas. Drunk, disorderly and trespass. Run them in."

That night the three men sat comfortably in the bachelor home of the Major. Their experiences had been decidedly unpleasant. All the political enemies of the Mayor had delighted in his arrest, and while it had resulted in nothing more serious than a fine, which he paid at once for the three of them, still, it was a humiliation which rankled the spirit of the proud ex-soldier. Besides, his legs hurt. There must have been a poison in the tendrils which was infecting the minute wounds. He sullenly bit on the end of the cigar that he was smoking. The other two watched him closely. At last he threw the butt into the ash tray and growled.

"That stuff is growing fast. By morning it will fill the whole damn hole. Perhaps by tomorrow it will start to cross the fence."

"Are we just going to sit here and do nothing?" asked White.

"The people ought to be warned of their danger. When it gets into the road, the little children playing there—you know what might happen to the little children. And after all, Major Young, you are the Mayor of the town. You owe something to your office."

The Mayor of Yeastford looked sharply at the Englishman.

"What do you think I ought to do?" he asked.

"Let's wait till morning," urged White. "Then we can go and see just what the situation is. I guess they won't arrest us for just walking on the street or the sidewalk."

THAT is what they did; just waited till morning. All during the night the plant came out of the hole and all during the night it climbed up the hill and up on the trees and it grew, as well as crawled. The morning came, bright and free from the fog of yestermorn. The men, after a leisurely breakfast, walked towards the swamp-hole. Even from a distance they could easily see that there was a change in it. The trees looked larger and greener, and as they neared the hole they saw that it was not a hole any more; there was a large hill of green ivy with a few dead trees sticking their bare branches through the white and green leaves, and the whole mass was moving with a sickening undulation that made the three observers shudder.

They were not the only ones watching the hole. Thomas, the policeman, was there, and Hiram Jones and half a dozen others, and as many women, who were holding their children tightly by the hands. One of the women was talking in a shrill tone to Jones, and holding her three-year-old child in her arms.

"It's dangerous!" she screamed. "You own that land, and you ought to do something. I tell you it was dragging my child down there when I heard the scream and ran and pulled her loose. I was pealing potatoes and, luck would have it, I carried the knife with me. You going to let that weed grow there and kill our children?"

"Bosh!" sneered Hiram Jones. "It is just ivy. Started to grow there and the swamp-hole was so rich it grew fast. Just ivy, I am telling you. I am going to make cuttings of it and sell it for ten cents a cutting. Lots of folks will buy a fast-growing vine like that for ten cents. I'll show you what I think of it. Bah! I'll walk through it."

He jumped over the fence and started down the hill. Mayor Young called to him to stop, to come back, but he kept on. That is, he kept on for a little while, and then he turned around and started to scream. It was a shrill, animal cry, and before it was ended the ivy was over him, barring him from the onlookers except for a few undulating movements. Another scream, and then silence.

The ivy started in a hundred places to cross the road. The folks of South Yeastford shrank back from it. Women grabbed their children and ran trembling to their nearby homes, shutting the doors and locking them. Thomas walked over to the Mayor.

"What does it mean, Major?" he asked. There was no doubt about the fact that he was bothered. "Should I get some of the boys and go in after him?"

"Better not, Thomas. He is going to stay there and so will anyone else who goes in there."

"But it is just a plant, ain't it?"

"Yes, it is just a plant," the Mayor replied, rather absently. "Just a plant. I think they call it ivy, Thomas. You go around and tell all the women to keep their children indoors. Mr. White and Mr. Milligan, suppose we go back to my home and talk this over. I am sure that we can do no good by standing here and watching that damn thing grow. At the rate it is going it will be across the roads by noon, and then—well—we will either have to stop it or make the people get out of their homes."

In an hour the Courthouse bell called the men of the town to a mass meeting. The bell was used only during Court week or in case of fire. Naturally the men of the town were curious. The Mayor lost no time in telling them the reason back of the meeting. He talked to them right from the shoulder; there was no mincing of words.

"The men of this town had better get axes and knives and hatchets and start fighting," he ended. "Otherwise, the people in South Yeastford will be driven from their homes in a few days. And they had better leave if the ivy comes near them. I am going to leave this in the hands of the Councilmen, and I and my guests are going to see the Governor."

Of course, there was endless talk. Everyone knew that the Mayor had been fined the day before for disorderly conduct. Perhaps he was still drunk. Still, most of the men who attended the meeting left it to walk over to South Yeastford. What they saw there was not

especially assuring. The ivy was now over the road and starting to grow over the lawns on the other side. An automobile had been driven over that street, but it had been caught by the ivy, and the man driving it had barely escaped with his life. It did not take the curious spectators long to realize that they had to start in and get busy. They did so, but without discipline or order, each man for himself and in any way and place that he wanted to. They worked all the rest of that day, and then, rather satisfied with clearing the street, they went to their homes for the night.

The next morning the ivy had recrossed the street and was curling around some of the houses. By that time the State Constabulary, under orders from the Governor, arrived and took charge of the work. It was rumored that several regiments of State Militia had been ordered out. Eager newspaper reporters began to interrogate the town people. Thomas, the policeman, was in his glory. He was especially clever in describing how Hiram Smith had yelled as the ivy dragged him under.

It is an interesting fact that the Governor gave one hundred percent credit to the story told him by the three visitors from Yeastford. Major Young, White and Milligan had been able to show him that a very real danger existed in his state of Pennsylvania. He promised the Mayor all the help that the state machinery could afford. He even offered to come to Yeastford himself, as soon as he could do so. After the conference, he gave a long interview to the newspapers, in which he spoke much about himself and little about his three visitors. One would judge, from reading the article, that the Governor had been the first one to discover the ivy and to recognize its danger.

On the fifth day two regiments of National Guards and over a thousand citizens were actively fighting the growing ivy. The men were working in relays. The work was being performed in an orderly and systematic manner. With the greatest difficulty, the roads were kept clear and the ivy was confined to the swamp-hole.

The fight to keep the ivy inside the fence was apparently a fairly easy one. Every night the ivy grew, and every day the branches that went over the fence were cut off. Of course, it took till nearly dark to finish the day's work, but when darkness came the road and sidewalks were cleared of the vegetating threat. There were some casualties, but the offensive powers of the plant seemed to be considerably diminished by the multiple traumatisms that it was suffering. It looked like an easy victory. Even Milligan, with his superior knowledge, was hopeful of success. On the second day White had returned to New York for further study of the plant in his laboratory. He did not return till the sixth day of the fight.

On the train from New York he thought over the situation. As the train neared the Water Gap he went out on the rear platform. The Gap was passed and then the pulp-mill and the track began to parallel Broadhead's Creek. There, above the power dam, he saw something that made him turn white. He was still swearing when he jumped off the train at East Yeastford. Milligan, who had received the wire announcing his return, was astonished to see the usually placid biologist so upset.

"Milligan, what have those fools been doing?"

"What do you mean?"

"They have been cutting off that ivy. What did they do with the pieces?"

"They must have carted them away. I know. They took them in carts and dumped them into the creek. Some they took up on Fox Hill."

"They were fools and so were we. They should have been warned. Fire! That was what was needed! Fire! Perhaps it is too late now. Every piece that had an aerial rootlet and had a chance has started to grow. Broadhead's Creek is full of it. It is starting to run up into the mountains around the Gap. Unless we act at once we are lost."

"But I do not understand," cried Milligan. "I thought it all came from a central plant of some kind, a variety of plant animal that lived in the hole. Don't the pieces die when cut off, as my fingers would if they were amputated?"

"No! That is going to be the trouble of it for this country. I have been working with it. Even the smallest piece, if it can obtain water, will start growing and make a new 'animal.' I wish I could escape from the word 'animal,' but I cannot. The 'thing' seems to have everything that we have in the way of vital systems, and I think that it has some kind of a mind. It can think. All that it has lacked so far is mobility. It seems to be attached to a central root and it just moves forward and grows as it moves, but the main body stays in the hole. That was the impression I obtained from what you told me, Milligan, and even in England, where no one fought it, it took a long time for it to cover just a small area. Here is a different story. We have been helping it. We threw hundreds of pieces into water and that water carried it down for miles. Perhaps some branches are drifting to Philadelphia at this minute. I am sure the whole Gap area is infested."

After that, fire was added to the weapons used. It seemed to work for a while, at least around South Yeastford. But in the woods of the Water Gap it was a different story. There the forests were filled with small summer cottages and large hotels. There was a great investment. Fire in the woods meant burning buildings. The hotel owners started legal proceedings. There were injunctions and counter-injunctions. It all meant delay.

EVEN at that time America was not air-minded. Had she been, the use of bombing airplanes would have been thought of at once. As it was, over two weeks passed before it occurred to anyone to try the extermination of the central plant-animal by bombing from the air.

Once thought of, everyone wondered why it had not been used the first day. Ton after ton of T.N.T. were dropped into the Swamp-Hole. The town of Yeastford was shaken by the explosions. Windows were shattered. When the attack ended, the hole was just a mass of pulverized rock and shattered trees. There was nothing green left. The victory was so easy that the authorities wondered at their fright of the past weeks.

Yeastford seemed safe. If the Water Gap was in trouble, it was their own fault. The Governor of the State turned the matter over to a special committee and started to build his fences for the next election. Up on the barren mountains of the Gap the ivy seemed to lose its terror. People simply learned to stay away from it.

Meanwhile it was growing in the Delaware river. In this period of the war the attacking animal showed its diabolic cleverness. Of course, it was a thousand separate animals under the river, but each one, originating

from the same parent stem, seemed to partake of the original central nervous system, and one of the remarkable points in the entire Ivy War—for so it was to be termed in the histories of the future—was the ability of all the plants to work in perfect synchronized harmony with each other.

The plants grew down the river. Biologists later on stated that the original home was in deep subterranean lakes, where it lived the part of an aquatic animal. It certainly showed its ability to live under the waters of the Delaware. It gave no evidence of its existence. Not a leaf appeared above the surface of the water. It simply stretched its long branches southward along the bed of the river, and as those branches grew into long submarine cables, they grew thicker until many of them were over a foot in diameter and looked like large water snakes, as their whitish brown sides appeared through the boiling waters of the occasional rapids.

The branches grew down the river till Philadelphia was reached. Once more the combined intelligence of the plant-animal showed itself in not making an immediate attack. With flame, dynamite and ax, regiments of men were fighting the menace on the slopes of the mountains around the Delaware Water Gap. But no one thought of searching the Delaware River between Philadelphia and Camden; and had anyone thought of it, it would have been difficult, almost impossible to exterminate a mass of tangled roots stretching for miles along the river front and thirty feet deep in the channel mud. Meantime the stranger was growing, gathering strength, preparing for the conquest of the city.

In spite of the many conjectures and surmises, no one ever determined positively whether the ivy had a language or some method of communicating with its various parts. One thing is certain and that is the fact that during the whole war it showed the intelligence of a thinking unit of life. For example, instead of concentrating its forces on a small town, it deliberately passed Portland, Easton, Trenton, and waited till it reached one of the great cities of the East, Philadelphia. Once there, it did not send a single attacking branch to the east side of the river, to Camden, but put all its energy into the conquest of the larger city.

The time that it selected for the attack was opportune. It was a night in early spring, cold and damp with fog. No one was out on the street, save from necessity. The street lights gloomed like sullen stars overhead. The wet streets and the moist air served as a blanket to deaden every sound. Then, at midnight, when every watchman was hunting the warmth and dryness of shelter, the plant sprang forward to the attack. One plant, perhaps, but with a thousand parts; one animal, it might easily be, but with a thousand arms; one intellect, but with a thousand deadly attributes.

Up Market, Walnut, Arch and many streets running west from the river the plant advanced to the attack. It was silent in its growth, murderous in its desires. Watchman after watchman died with the horrid coil around his neck, giving, through a hundred punctuate wounds, his life fluid to feed the plant and passing out of consciousness without the least idea of what was killing him. Into the cellars, the bootlegger's joints, the cheap boarding and rooming houses, the laterals spread and collected therein their harvest of death.

And as the "animal" tasted more and more blood it worked faster, gathering its harvest of death It worked faster and even more silently. The city east of Broad Street was surrendering to the enemy without even knowing that there had been a battle waged. Aerial rootlets fastened to the stone buildings, and up these buildings the terminals grew, searching for their prey through every open window, every unlocked door.

Morning came, a lovely spring morning. Before the kisses of the sunbeams the mist melted in gentle resignation. The city awoke, feeling that it was good to be alive, and not till then, when the first living people started to invade the district east of Broad Street, did the city and the nation realize what had happened during the silent watches of the night.

Those in that portion of the city who had escaped death during the dark hours gayly walked out into the street without the least intimation that anything was wrong, and once there, died quickly. And whether they died quietly or with screams made no difference to the "animal" that closed around them and sucked out their fluids.

Even in the daylight it took the forces of Philadelphia some time to realize what had happened and was happening to them. It was not till nine in the morning that the scientists suddenly appreciated the fact that the ivy of Yeastford, the plant that was still being fought on the mountains of the Water Gap had in some peculiar way reached Philadelphia and was taking the city by storm.

IT was something greater than the business of a city or the affairs of a state. This was something that menaced the life of the nation. If an unsuccessful fight were made against the plant in Philadelphia, what was to hinder it from attacking other cities? Wilmington? Baltimore? and even Washington?

The defense was slow in starting because it could see, at first, nothing but the advanced portion of the enemy. It was plain to be seen that Market, Chestnut, Arch and Walnut Streets were slowly filling with a mass of green leaves, but it was not until daring aviators had made an aerial survey of the situation that the defenders realized the important fact that the attack had been inaugurated from the river. Later on, when ship after ship had been surrounded, pulled down into the river mud and everyone of the crew killed, the real significance of this became apparent.

The ivy grew upward as well as onward. Front Street, within twenty-four hours, was a mass of green embowered houses, and some of the older ones were already beginning to be pulled to pieces.

The Governor of the State heard the news and he recalled the three men from Yeastford. He lost no time in trying to get in touch with them over the long-distance telephone. Here more time was lost. The Mayor had gone to New York for a rest. White was working in his laboratory, trying to find some method of fighting the ivy. Milligan had strangely disappeared. Unable to locate any of the three, the Governor was momentarily at a loss as to what to do next. In despair he sent the entire National Guard of the State to Philadelphia, under the command of the Adjutant General of the State, while he went to State College to talk matters over with the Dean of the Agricultural Department. To his surprise he found that gentleman had left for New York. Not till later did he realize that the Dean had gone to White for help as soon as he had heard of the trouble, realizing that White, of all men, was the one most likely to be of real assistance.

The first day and the next the same tactics were employed in fighting the ivy; that is, that had been used in South Yeastford. The effort was made to keep it east of Broad Street. The terminal branches were cut off as they tried to cross the dead line. As company after company of the guards derailed they were marched to the fighting line and put on sentry duty. No one was allowed to even try to enter the doomed area. Death, by this time omnipresent, kept anyone from leaving. As though satisfied with its day's work the ivy stopped going westward, and seemed satisfied to solidify its position in the east of the city.

It had captured the subways, putting an end to all travel there. The defense had an idea that it was working silently through the sewers of the city, but the danger was so new, the problem so intense that no one had the courage to speak openly about what *might be going on under the city*. The end of the second day came, with Broad Street clear and a strange battle going on between the military and financial forces of the city. The air forces were anxious to drop depth-bombs into the Delaware River, to try and blow the enemy to bits at its headquarters. They wanted to throw T.N.T. into the great green masses on Market and Arch Streets. They were anxious to start a war to the death. And the money interests, the financiers who had their millions invested in real estate and stores of precious goods east of Broad Street protested. They appealed to the Governor, they cried to the President, they even sent messages to the Allwise demanding less harsh measures.

Meantime, the ivy rested. At least, it seemed to rest. What it really did was to send a hundred roots up the Schuylkill River and on the third night invade the city from the west. The dawn broke with every bridge, every railroad track covered with ivy and evidences of having been rather rapidly pulled to pieces. The Pennsylvania, the B. and O., the Reading were all forced to suspend operation. The city could no longer be fed.

Conferences began. Interviews were given. Great personalities ventured asinine opinions. Every Tom, Dick and Harry, who was able to do so, rushed into print. There were a thousand remedies offered, none of which could be of any possible use. The Red Cross, the Regular Army, the Grand Old Party and the Amalgamated Labor Unions each started in to do their bit. But everybody was working in a different way to accomplish the same thing, and no one was quite sure of just what he really wanted to do.

Meantime the plant was growing, the "animal" was becoming more powerful. It was gradually gathering in its forces on every side of the city. The citizens started to leave; there was little suffering, and after the first day, there were practically no deaths, but the President's advisers realized that a panic would start just as soon as the city dwellers knew the possibility of their being entirely surrounded. So, they silently encouraged the depopulation of the city.

At last the national danger was so plainly seen, that orders were given to bomb the rivers and the city east of Broad Street. That order would have been carried out had not White arrived in Philadelphia and asked for a delay. He made a peculiar figure before the important personages gathered at Army Headquarters in City Hall. He was rather cheaply dressed, was without a hat and carried a Boston bag in one hand a gallon demijohn in the other. It took a good deal of introducing to make the Generals realize that the man before them was the leading expert in plant physiology in the Western Hemisphere.

"EVER since this ivy war started in the swamp-hole in South Yeastford," he began, "I have been trying to devise some scientific method of fighting it. I have felt the uselessness, the utter hopelessness of making a frontal attack on it in force. We were able in Monroe County to cut it to pieces, but each little piece simply started in to make a new plant with all the devilish brains of the mother 'animal.'

"I started to study this peculiar form of ivy. I found that it had a nervous system and through this nervous system it was able to communicate with its various parts. But, most important of all, was the discovery that it had a circulation that was rather like that of the fetal cardio-vascular system. It actually pumps fluid from one end of its body to the other.

"Before I arrived at this conclusion, the scientists who studied plants were at a loss to explain the movement of sap in the larger forms of vegetative life. Atmospheric pressure would only raise the sap thirty-four feet, the height of the water barometer. Osmotic pressure might play a part, but it is so slow that in the giant *Eucalyptus Amygdalina* it would take a year of osmotic pressure to take sap to the top, four hundred and fifty feet above the ground. Nothing explained this movement of sap till I found in this ivy a propulsive tissue very much like the heart muscle.

"Once I found that, I realized that the ivy had a circulation in two directions. Much of the time I have been wondering whether I was working with an animal or with a plant, but that does not make any difference, because I have found the thing to kill it with."

"Well, what is it?" yelled an irritated General.

"Simply this," and White held up the gallon demijohn. "This is the stuff that will do the work. But I ought to tell you that I think this ivy is more of an animal than it is a plant. At least its sap has cells in it, different from our red corpuscles, yet, at the same time, a little like them. When I found that out I started to make a haemolytic toxin, something that would have the same effect on the sap of the ivy that poison of the cobra serpent has on the blood of man. It was not very easy, but I found it, and for the last three days Milligan and I have been over in Wolf Hollow north of the Gap, experimenting with it. And I tell you one thing: it kills the ivy and it kills it quickly. Inject it into this blood stream at the terminal end of the animal and it travels back through the animal-plant like fire and literally kills as it travels.

"You give me a company of soldiers to help me and Milligan and I will liberate this city in a few days, and then I am going to advise the President to start a war of extermination against every ivy in this country, no matter how harmless and innocent it may seem."

One of the Generals turned to another.

"Is it worth trying?" he asked.

"I think so," was the reply. "We will wait twenty-four hours and at the end of that time if there are no results, we will start the bombing planes."

Half an hour later a peculiar event was taking place at Broad and Market Streets, on the northwest corner of Wanamaker's store. A company of soldiers had isolated a branch of the ivy, had cut off all the tendrils and had

pulled it out till it lay like a writhing snake, its end almost touching City Hall. It twisted and pulled and squirmed and almost got away from the hundred men holding it fast. Sitting on it was White, with Milligan helping him fill a 25 c.c. glass septic hypodermic syringe. At last it was filled and the three-inch hollow needle was plunged into the bark of the ivy, the toxin being slowly injected into the circulatory vessels. Instantly the leafless branch dropped to the pavement. Back of its attachment to the store the green leaves were turning brown, the waving tendrils, seeking in everlasting motion their human food, dropped uncoiled and lifeless. A thick swarth of green ceased moving and hung dead on the side of the great emporium.

Walking a hundred feet across Market, White picked out another branch for attack. The same procedure brought the same results. Ten doses were given and then twenty. The aviators reported that long streaks of brown were appearing among the green and that these streaks were going back to the river. White asked for a few physiologists, whom he could train to give the injections. The men whom he wanted appeared as though by magic. Milligan directed the work while White went back to New York for a larger supply of the haemolytic poison.

Now that a means of defense was assured and a definite program arrived at, everybody worked in harmony. System grew out of chaos. Hope took the place of gloom. The nation, interested at last, financed the rest of the war. White was made a General, Milligan was decorated, and Major Young, promoted to a Colonelcy, was placed in charge of the Monroe County portion of the battle.

The war ended with the same rapidity with which it had begun. From the first the living organisms must have realized the hopelessness of the struggle, because they made a definite and orderly retreat. Tearing off their branches, they withdrew to their place of security in the rivers, and even there, realizing that they would be hunted for with grappling hooks, fled hastily to the ocean.

The nation, aroused to the peril, conducted a systematic campaign of extermination. The Delaware River, from the Gap to the Capes, was thoroughly dredged, and whenever a branch was found it was given its dose of death dealing fluid. And not till the army of science was satisfied that there was no more enemy, did the conflict stop.

Colonel Young went back to Yeastford. He had no trouble in being elected Mayor for the seventh term. The morning after election he was in his office receiving the congratulations of his friends. In walked William Coonel, as usual, slightly spliflicated. The Colonel recalled the previous visit of the inebriated worthy.

"Well, Bill," he said kindly. "Sit down and have a cigar. It was a great war while it lasted, but we won out at last, and the ivy is no more."

"Yes, I guess the war is over, Colonel," replied the hunter, "but, after all, the fact that we won ain't going to bring me back my rabbit hound. He was a great dog, Colonel, too good a dog to be eat up by a good-for-nothing plant."

THE END

What Do You Know?

READERS of AMAZING STORIES have frequently commented upon the fact that there is more actual knowledge to be gained through reading its pages than from many a text book. Moreover, most of the stories are written in a popular vein, making it possible for anyone to grasp important facts.

The questions which we give below are all answered on the pages as listed at the end of the questions. Please see if you can answer the questions without looking for the answer, and see how well you check up on your general knowledge of science.

1. What would be the final effect of sufficient increase of frequency of rotation of the sun? (See pages 105-6.)
2. Where does a great region of asteroids lie in the heavens? (See page 114.)
3. Can you name one of the larger asteroids? (See page 114.)
4. How many are the greater moons of Jupiter? (See page 115.)
5. What is the approximate time of rotation of Jupiter? (See page 117.)
6. Which of Saturn's many moons has the greatest mass? (See page 118.)
7. What is the impressive feature of Saturn's mass? (See page 118.)
8. How many moons has Neptune? What is one distinctive feature thereof? (See page 121.)
9. How does the size of Neptune compare with that of the earth? (See page 122.)
10. What are the relations of chemical reactions to life? (See page 132.)
11. What is the specific gravity of the earth? (See page 142.)
12. How many kinds of earth waves set up by earthquakes are there? (See page 142.)
13. Can you describe the details of an operation for appendicitis? (See page 158.)

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A Circe

One would have been sufficiently aware of this fact had one visited Gilcrest's laboratories before the disaster, and observed the army of freaks, monstrosities and living contradictions that they contained.

OUT of all the millions of sufferers during the Reign of Confusion of 1964-65, there were not more than a few hundred who understood the original cause of the disturbance. To most of us, baffled and bewildered, the trouble seemed to descend like a veritable curse from heaven; and in our dismay and terror, it was as if the very underpinnings of the universe had given way, and all known and tested laws had been suspended. Therefore it was but natural that a wave of superstition should sweep the land; but natural that men, finding all accepted beliefs failing them, should fall back upon the emotions of savages, or of panic-stricken wild things. For who, five years ago, could have foretold that lambs were to become like lions, and lions like lambs, and supposedly harmless creatures to prove themselves our mortal foes?

Now, however, when the menace has passed and the world has regained its sanity, we can begin to look with perspective upon the events of 1964-65, and take proper account of causes and effects. And we can perceive that the Reign of Confusion was but a by-product of our own scientific ingenuity.

Or, more specifically, it was a by-product of the ingenuity of one man. That man, Theodore Gilcrest by name, was director of the zoological gardens recently established at Washington under governmental auspices. Had he confined himself to his duties as director, there would have been no reason to pen these words, and the world would have been spared incalculable suffering; but, as we have come to learn, he had a penchant for scientific experimentation, and his position at the head of the zoological gardens offered him an opportunity to indulge his lifelong hobby. It was not generally known at the time that he was conducting researches at the expense of his four-footed and winged charges; and, had this fact been revealed, his dismissal would probably have followed. But for several years, in a private laboratory adjoining the zoological grounds, he was wont to experiment upon an occasional wolf cub, or antelope, or serpent, as well as upon plants of various kinds and upon large numbers of cats, dogs, and insects. It must be said for him, however, that while his use of government property was unlicensed, the purpose that actuated

By Stanton A. Coblentz

Author of: "The Gas Weed," "The Wand of Creation," etc.

Man's familiarity with animals begins with his earliest days, and the nature of his four-footed friends and enemies and of the various footed creatures of the insect world is deeply assimilated and becomes a part of his nature. But suppose that by some ray process which might be discovered sometime in the future, new and unexpected forms should be developed—if, for instance, the harmless sheep became ferocious animals, or the worm should fight the hen! Strange things have been done in the laboratory before. Why should the scientist by direct laboratory processes not do even more than has ever been achieved by the slower natural processes employed by the breeder of prize animals? The ductless glands are responsible for so much in the life processes—what might they do if it were possible to control their action?

# of Science

Illustrated by MOREY

him was never mere idle curiosity; nor was he in any way able to foresee the tragedy that lay ahead. For he was a scientist, conducting his investigations in the manner of thousands of his kindred, although with more brilliance and ingenuity than the majority; and he was pursuing the scent of what promised to be a world-moving discovery. He had ferreted out, in a word, the secret of a biological alchemy; he had solved the problem of the artificial mutation of species. And he could produce at will new varieties, even new genera and families of animals and plants!

Unfortunately, it is impossible, at this late date, to describe precisely how Gilcrest achieved his extraordinary result; for the inventor, horrified at the eventual outcome of his discovery, has destroyed the formula and so precluded for all time the repetition of his experiment. But this much is known: he operated by means of a new light-regulating machine, akin to the X-ray, although different from it in several essentials; and he availed himself of those parts of the spectrum invisible to the human vision. Opinion is divided as to whether he made use of the ultra-violet or of the infra-red rays, and he himself has resolutely refused to break silence on the subject; but what he does acknowledge, since this admission can furnish no vital clue, is that he applied the rays for definitely regulated periods to the reproductive organs and germinal cells of animals, and to the seeds, spores and pollen of plants, thereby producing a chemical change that operated in some obscure way to transform species. Gilcrest himself was never able to foresee just what direction that change was to take, and could only surmise that he had modified the life-bearing cells in some essential, creating in a few minutes the effect of hundreds or even thousands of generations of evolution. But while the alterations appeared to follow no regular law, they were governed in one respect by a rude uniformity: they worked by a rule of opposites, and in most cases the transformed species assumed qualities as unlike their former selves as fire is unlike frost.

One would have been sufficiently aware of this fact had one visited Gilcrest's laboratories before the disaster, and observed the army of freaks, monstrosities and living contradictions that they contained. But nearly all those freaks and monstrosities have since made themselves only too familiar to the world—so that it would be pointless to describe them at this place. It will be necessary to remark, however, that Gilcrest wished his new species to prove of genuine value to mankind, and that he had found encouragement in the fact that they would breed true to type, thereby giving hope of their indefinite perpetuation. . . . And the great biologist's expectations might indeed have found justification, had it not been for the catastrophe that frustrated his years of effort in one hour and flung open a Pandora's box upon the world.

Gilcrest has never been able satisfactorily to explain the fire that attacked his laboratory late one night—whether it was due to lightning, or to incendiaries, or to an electrical short-circuit; or whether one of the transformed monkeys, finding a box of matches carelessly left on a laboratory table, had let havoc loose upon himself and his fellows. Gilcrest himself is inclined to favor the latter explanation; but, whether or not he be correct in this, the fact is that he was awakened one night with a sooty odor in his nostrils and with the red flare of fire before his eyes. And, to his consternation, he discovered

that his laboratory, which lay just behind his house, was a scene of spouting smoke and flame. Not more than half awake, he gave the alarm and aroused the household; then, long before the arrival of the firemen, dashed to the laboratory door, and fighting his way through the strangling fumes, flung open cage after cage, setting free the screeching, screaming occupants. Behind him he heard the flapping of panic-stricken wings, the rushing of panic-stricken legs, as the released birds and beasts made for the doorway and vanished. Yet never for one moment, in his excitement and alarm, did he reflect as to the folly of letting these creatures loose upon the world; maddened at the thought of their peril, he worked in reckless disregard of his own safety, until, assisted by neighbors and firemen, he had rescued most of the animals, as well as a considerable number of the plants that grew about the windows in flower-pots. And when at last, scorched and half suffocated, he extricated himself from the ruins, it was in a state of torment and nervous collapse that was to confine him to his bed for a month. . . . None the less, between delirious ravings and mutterings, he was heard to rejoice that his creations had been spared. Little did he suspect what a plague he had bequeathed to mankind!

A day or two later, the earliest signs of trouble began to be reported. A Maryland farmer, waving a stick at a creature that he mistook for a crow, was terror-stricken to find the bird attacking him and lacerating him about the hands and face. Simultaneously, a farmer in Delaware, about to shoot a chicken hawk, was dumbfounded to hear the supposed marauder bursting into song, which he declared to compare favorably with that of the field lark. Of course, neither report was believed at first—yet both were mild enough by comparison with that which lay in store. It was in the city of Washington that the first pronounced symptoms were observed; and the manner of their appearance was such that denial was impossible. Not one citizen, but a thousand, paused in astonishment to watch the little dog equipped with claws that enabled it to climb trees like a squirrel; and another thousand, at the lowest estimate, listened to the squirrel with a transformed larynx that permitted it to bark like a dog.

These, however, were the least of the new-born wonders. Others were more alarming by far. In certain sections of the city, a panic was caused by the announcement that several cats, reverting to ancestral habits, had become beasts of prey, at war with all human society; and no one could explain why it was that a score of lonely pedestrians, mostly women and children, had been pounced upon at night and dangerously slashed by the blood-thirsty brutes. Still more difficult to account for was the fact that rabbit-like creatures had been seen —surely, not actually rabbits!—which had forgotten the traditional timidity of their kind, and had no hesitation about approaching and biting unwary passers-by. But most horrible of all was the discovery that venomous serpents were wriggling about among the lawns of the Capitol grounds—serpents of an extraordinary kind, with monstrously overdeveloped heads and poison-sacs, combined with a swiftness of motion and a sagacity that made them almost impossible to slay. Only after one of these reptiles had had the poor judgment to sink its fangs into the calf of a United States Senator, and had made the Mistress of the White House execute a screaming retreat, did men in general recognize the seriousness of the situation.

But much more frightening manifestations soon began to appear. One of the most disquieting of all was the insect menace. Shall any of us ever forget the terror of the summer of 1964, when a new species of house-fly descended upon us, equipped with a blood-sucking paraphernalia that the mosquito might have envied? Shall we forget how our days were passed in torment, and how we could scarcely venture out of doors without being attacked by swarms of these little savages, whose ferocity was equalled only by their fecundity, and who left one's skin a mass of aching bites and blisters? Probably due to the transportation of their eggs in railway coaches and motor cars and in the garments of travelers, they quickly spread across the country; and, before the summer was over, there were few cities and scarcely a countryside in the United States in which one could safely venture abroad without covering one's face and hands with mosquito netting.

But worse still—though for a while it seemed impossible to believe that anything could be worse—was the new species of wood-burrowing beetles, whose jaws had the efficiency and the cutting power of steel blades. It is hard to say how many buildings they undermined, excavating in the walls and foundations and living on an exclusive diet of wood. It is only known that thousands of dwellings, apparently substantial a few months before, suddenly were in a state of collapse, their floors and walls giving way, their posts and pillars weak as cardboard. And invariably thousands of little gray-green beetles, scarcely a quarter of an inch in length, would be found complacently dining among the ruins.

But for the average man, if he were fortunate enough not to be made homeless by the beetles or goaded to self-extinction by the flies, perhaps the most distressing thing about the entire era was the confusion that gave it its name. One could not approach an ant or a butterfly and be sure that it would not squirt poison into one's face. One could not befriend a homeless dog without suspecting that it was about to spring at one's throat. One could not observe a browsing cow without fear that it would charge like a maddened bull. One could not feed a dove without danger of being slashed as by an eagle, or watch an eagle without the possibility of hearing it cooing; one could not be certain whether the creature swimming in a pond were a duck or a webbed hen, or whether the bird of brilliant plumage were a pheasant or a transformed sea-gull; and one would have to learn not to be surprised at seeing the deer giving chase to the fox, or the sparrow darting in pursuit of the falcon, or the worm turning and defying the early robin. Such sights, during those astounding years, 1964 and 1965, were to become the merest commonplaces; and the only thing that any one knew positively was that the action of all creatures alike had become unpredictable. Had nature herself gone crazy? Had the laws of thousands of years suddenly been suspended? Not so! as we of today realize well enough; the trouble was due solely to those misfit creations of Gilcrest, all of which, whatever their particular characteristics, possessed one attribute in superlative degree: the power of reproducing rapidly and prolifically, and of endowing their descendants with their own astonishing qualities.

But the changes introduced by Gilcrest did not confine themselves to the animal world. They were botanical as well as zoological in their nature; and there were those who maintained that the worst pests of all were the new plants. One could hardly be blamed for ob-

jecting, for example, to the exquisite red rose with the odor of carrion; or to the lily with the concealed sabre-like spines that would leap out unexpectedly and stab one; or to the grass with the tar-like exudation, which made whole fields resemble great patches of sticky fly-paper; or to the little vine-grown fruits which, despite their similarity to the blackberry, had an acrid, unforgettable taste comparable to that of ink. Or, again, one had a right to complain when the pollen of certain new plants contaminated the seeds of fruits and vegetables, so that cucumbers had a habit of becoming sweet like watermelons, and watermelons of being sugarless as cucumbers; while one could never be sure, upon opening an orange, whether it was not to be sour as a lime; and, upon slicing a tomato for one's salad, one would feel fortunate if it did not have the flavor of red pepper. It was as if nature, like some malicious jester, had performed feats of jugglery, until everything was topsy-turvy, and one could not know when one was to fall victim to some unprecedented prank.

But what could be done to restore the world to sanity? How conquer the formidable array of animal and vegetable freaks? This was a question of crucial importance, for mankind was being more than harried and annoyed; it was being demoralized; men no longer went as usual about their daily work; they toiled, if at all, in a nerveless, half-hearted manner, and with the irritation of beings under a perpetual shadow; incalculable numbers were giving way to hysteria, and even to insanity; thousands upon thousands were roaming the land at random, without reason or purpose; crimes of passion and violence were becoming frequent as never before, and at the same time there was an aimlessness never previously observed in the ordinary affairs of life. Had the Day of Judgment been impending, men could scarcely have behaved in a more haphazard, irrational way—for the solid earth seemed to be slipping from beneath them, and in the ensuing chaos they had no firm goal at which to clutch.

Nor could the wisest among them offer much aid. Philosophy had no word of advice to utter; religion stood back dazed and speechless; even science apparently could not extend a helping hand. And yet science was doing its eager best to solve the dilemma; science had flung open ten thousand laboratories, wherein physicians and biologists, bacteriologists and chemists were laboring to combat the pest. The record of the year and a half of research has many an heroic anecdote to show, but in a practical way it accomplished nothing. During the interval, Gilcrest's plants and animals had spread to every corner of the globe, and yet not one thing had been done—absolutely not one thing—that promised to end the Reign of Confusion! In vain did the researchers experiment with poisons and deadly fumes; in vain did they attempt to wipe out the invaders by methods of direct slaughter. No task ever undertaken has appeared more hopeless; the new species were not only almost impossible to recognize at sight, but they multiplied so rapidly that in most cases two were born for every one that was killed. Such, indeed, was their rate of increase that it seemed likely that the world would soon be over-run with them! And the more pessimistic—who included two persons out of every three—began to predict that before long the earth would become uninhabitable for man.

By the summer of 1965, it seemed likely that this prediction was to be fulfilled. Throughout the length and breadth of the civilized world, pestilence was spreading; agriculture had almost come to a standstill; commerce and industry, when they had not ceased altogether, dragged on as lamely as a dog on three legs. And since little food was being produced, and still less transported, the inhabitants of all the great cities of the earth began to cry out despairingly for bread; while half a dozen plagues, arising simultaneously, as plagues always will arise in time of want, began to take toll of the famished natives of all lands. And meanwhile there was no one to seize control of the disorganized wheels of world affairs, no one to put the farmers back upon the land, the laborers back in the abandoned factories. Only a few persevering scientists, struggling to stem the tide of disaster somewhat as a child with a toy shovel might struggle against a river floor, were still seeking a solution of the problem; and even they were not far from confessing themselves beaten.

In that terrible summer of 1965, the hospitals swarmed with the sick and dying; the streets were made dismal with the wailings of the bereaved, the moans and sighs of the hungry and the hopeless; and the churches of all lands were filled with weeping and praying penitents who foresaw the end of the world. Even the more courageous fraction of mankind, who held that our race would yet come to terms with the invaders, were assured that the world would henceforth be a harsher and more difficult place in which to live. And meanwhile none, not even the most optimistic, anticipated the sudden and complete vanquishing of the enemy.

Or, rather, none—with only one known exception. In those hysterical days, when most of us hovered precariously on the brink of unreason, few persons paid much attention to the insistent young woman who proclaimed that she had had a vision foretelling the end of the Reign of Confusion. "All the new species are lacking in one essential," she contended, "and that is racial tenacity of life. The very force that brought them so suddenly into being will remove them as suddenly from our midst. They are freaks who owe their existence to the creative energy in the light rays that produced them; but that creative energy will be exhausted very soon, just as the electricity in a storage battery is exhausted; and all the plants and animals will perish."

Owing to the definite terms in which this prophecy was couched, there were those who suspected that it did not represent a vision at all, but rather a shrewd bit of scientific foresight. At all events, the young woman's prognostication was to be tellingly verified. Early in the autumn of 1965, when the world had sunk to its lowest depth of despondency and want, and when pestilence was ferreting out the quarters of rich and poor alike, an extraordinary fact was announced. The stinging flies were growing less abundant, and in some districts had entirely ceased to be seen! And the burrowing beetles were not half so noticeable as before! At first, upon hearing these tidings, men merely opened their eyes in surprise, and then, with hopeless nods, turned away—such false reports had reached them too often! But it was not many weeks before a gleam of hope began to appear in even the most hopeless eyes. It seemed incredible, but it was undeniably true!—one no longer saw dogs climbing trees; sparrows did not growl or ravens sing, canaries no longer displayed the inclinations of hawks! But thousands upon thousands of creatures, which, upon investigation, proved to be of the new

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Through *the* Veil

By Leslie F. Stone

Author of "Out of the Void" and "A Letter of the Twenty-fourth Century"

Why, out there was a world of tiny flying things, no larger than a half a dozen inches high and flying about like butterflies and bees!

MUCH study has of recent times been given to the various branches of legendary science, among which is included the study of Irish folklore. Unquestionably there is here a fertile field for writers of scientific fiction, for it lends itself to much investigation of the history and traditions of a race. Miss Stone gives us the true Celtic atmosphere in this charming short story of the fourth dimension and Irish folklore.

Illustrated by DE PAUW

TRUE, Jack Warren had not seen his one-time friend, Charlie Keller, for a number of years, but then, he had not been in New York but once during that time, and that had been a matter of business with no time for social visits. If Keller had come to Rochester, Jack did not know, but the fact remained that it had been years since the two had seen each other. And now Jack did not know why he had come to one of the old brownstone fronts, where Keller continued to live, even though downtown New York was encroaching upon the old street where Grandfather Keller had built his home.

At college Charlie and he had been good friends. They might even have been called chums in those good old days of camaraderie, but with the graduation each had gone his own way, each to his own home-town, each to his own interests. And now Jack knew that Charlie was dabbling in science. At school he had been a shark for chemistry and physics, so it was not unnatural, since Charlie's old man had left him plenty of wherewithal, with which he could devote himself to his old love. Once or twice Jack had seen his name in the papers, referring to his work in the field of X-rays. There was even a certain little doo-dad on the medical X-ray machine which bore Keller's name.

And here he was waiting in the old antiquated drawing room of the Keller brownstone, while an almost as antiquated butler went to inform his master of the advent of a guest. In a few minutes Warren heard footsteps running down the stairs and Charlie of old stood before him. The one-time chums shook hands warmly, voiced equally as warm greetings, and surreptiously eyed each other for the changes the years must have brought. There followed a few minutes of reminiscences of college days. However, through it all Keller appeared restlessly nervous, and after the first wave of greeting had passed he spoke in jerky sentences. "Pardon my rush, Jack, old man, but I've just left some work of mine up-stairs that can't stand waiting. Wait until I finish—or would you prefer to come to the lab. and wait? Just a half hour or so and I'll be ready to show you the town, or what have you?"

"Oh, sorry, if I interrupted you, Charlie. I'll go along with you. I understand you've done some big work in your time."

Keller was modest about what he called his success as he led the way up the carpeted stairs and into the large room upon the the third floor that he called his lab.! Jack was surprised to discover the wealth of equipment that filled the room. He himself had not been in a scientific laboratory since he had left the university. Keller left him alone while he went into a box-like affair in one corner of the room that Jack recognized as a dark room. Left alone, Warren strolled about the room gingerly peering at the various apparatus, retorts, arrays of glass tubes and other paraphernalia. He came to stop before what looked to him like an ordinary camera, but it had several strange looking attachments, which he did not try to understand. Then Keller appeared from the dark room carrying several small sheets of developed photographs that he was handling carefully. On seeing his guest looking at the camera he observed, "Ah my Z-ray camera interests you, eh?"

Warren turned to him. "Z-ray? Isn't that something new? I thought you were devoted to the X-ray."

Keller grinned. "I had to study the X-ray to be able to discover the Z-ray. They work in conjunction."

"Oh, do they?"

Keller seemed hesitant. Then he thrust forward the photographs that were still damp from the developing solution. He watched his friend's face as he studied the pictures. Warren looked at them a minute, then he was grinning. "Oh, you and Conan Doyle, eh? Since when have you been interested in fairies, Charlie?"

Keller smiled back. "Ever since I was knee-high to a duck, Jack."

Warren whistled. "But really you are not going into this thing seriously, old man! Why, you'll be a laughing stock, if that gets out. Is that what all this means?" and he waved an arm to take in the camera and the laboratory.

Keller nodded. "It's a long story, Charlie, and I've not told a soul yet, but since you dropped in on me on the very day that I found it, you are welcome to hear all about it!"

"You mean, Charlie, that you have actually photographed those things—that. . . ."

Keller nodded again. "It is true, and if you don't believe me I'll take you out in the garden and let you photograph them yourself! It was lucky for me that I found one of the 'holes' right in my own garden!"

"WHAT in the world are you talking about? Tell, me, you haven't lost your mind . . . like so many of these inventor fellows do?"

The other laughed at that, and without another word he picked up the camera and led Warren downstairs and through a side door that led into a pretty garden in the rear of the house. One does not expect to find such a beauty spot in the heart of the fifties, and that had added to its charm in the days of Grandfather Keller. He had built up the entire square block of houses in his day, but in their center he had preserved enough ground to make the garden what it was. And it had been the

scene of many a fête in the old days. There was a frog-pond, and tall cedar trees on its rim, a rose garden that bore every species of rose known to man, a gravel walk that drifted in and about the hedgerows and a little bit of a sunken garden. At one end, against a tall stone mossy wall, was a loggia where were set a half dozen garden chairs, and here and there in the garden were arranged little bowers that invited a twosome. Keller père had been somewhat of a poet. Here as a boy Charlie Keller had spent almost all of his boyhood, and here had been many a love-quarrel forgotten. People had visited the Kellers just to stroll in the old-fashioned garden. And now Charlie had found another use for it.

He took Warren along the gravel walk to a corner where was placed a stone bench and near it on a pedestal stood a "round tummied" Cupid, ready to shoot one of his arrows. Keller squinted up at the sun. It was four o'clock of a mid-summer day so that the sun was still high enough for taking pictures. Carefully he set his camera on the bench and kneeling upon the grass he placed his eye against the peephole, and spent a half a dozen minutes in focusing it properly. He motioned to Warren to come close, and put the bulb of the camera in his hand. "Push," he told his friend, and Jack, as though to humor a maniac, did so.

"Well, now," observed Keller, "you've done it! You've photographed two fairies!"

Warren was now certain that the other was out of his mind, but he managed a grin, though he wanted to turn his back and leave Charlie and his toys forever. But Charlie Keller understood what was passing through Jack's mind and sympathetically he smiled. "Here, Jack, look in for yourself and ask yourself if you are dreaming or not," he suggested. "You think I'm crazy, but after you see what I have seen, decide then whether or not you call me or yourself insane."

Reluctantly Warren knelt and placed his eye to the sighting hole of the camera, expecting to see nothing more than the leaves of the rose bush that faced the camera's eye. And for a moment he did not seen anything, but Keller urged him to continue to look through. What was that beautiful shade of light that had crept into everything? The very light itself was entrancing. Then he saw something that so startled him that he lost his balance and sat on the ground with a plop. But he was back again at the camera staring with the greatest of wonder and misbelief at what he had seen.

They were a dozen feet away, or so it appeared in the camera. They were fairies, those little bits of ephemeral things with their gauzy wings and dresses of flower petals. And there was—by gosh—there was an elf—just as one sees them in children's picture books. Why, out there was a world of tiny flying things, no larger than a half a dozen inches high and flying about like butterflies and bees! It was incredible, but they moved and they were alive. There was one tiny creature sticking its head into the heart of a flower, a violet, and when it looked up again, it appeared as though it had just relished a tidbit!

Warren could not tear his eyes from the camera. It was the strangest and most beautiful sight he had ever seen. Then he looked on beyond the fairies, to a pretty piece of flower covered ground with clouds and blue skies overhead where before had been only a rose bush and the garden wall beyond! Realizing this, Warren took his eyes away and glared almost angrily at Keller who was standing a foot away and smiling broadly.

"Say, what's this? Are you trying to play with me, Charlie Keller? Why this thing's no more than one of those penny-shows you see in a machine in Coney Island!" He was blustering now over the hoax which he thought his friend had pulled upon him.

"Don't be a fool, Jack. Do you think I'd bother to bring you into the garden for that? And where could one photograph those things? No, my friend, you have simply been looking into the Fourth Dimension! And those creatures you saw there are really living and enjoying life as you see them. I could not have 'faked' such a scene. Now, could I?"

"But Charlie, it's impossible," muttered Warren, his blustering gone.

"No, no, Jack, it is the truth. Come into the house. I had better tell you more about it."

HE picked up the camera almost lovingly, and preceded Warren through the garden. About to enter the house, he paused. "No, on second thought, let's sit here in the garden. It's more pleasant, and besides, the story will sound better out here where it belongs." He led the way to the company of wicker chairs under the loggia. He pressed a buzzer and in a minute or so the antiquated butler came forth beaming, bearing a tray with its decanter of rare brandy and the glasses. Thus refreshed Charlie began to talk.

"As a child, Jack, I believed in fairies. Of course lots of children do—or used to. I don't know if they have lost the capacity of believing in this day of machines and traffic regulations—I hope not—for I can remember the joy with which I used to listen to all stories about fairies and their ilk. Not the stories of Fairy Princes and of Witches that one finds so prevalent in a certain type of so-called Fairy Tales, but the stories of the doings of the Little Folk. I think that of all writers Lord Dunsany had come closer to the real heart of the fairies.

"In those days I had an old nurse, Irish Nora. Perhaps that accounts for my deep love and understanding of the Wee People. Her mind was filled with tales of them as well of the banshees and witches, and the stories she told me of them were true—she averred that she had seen a number of fairies back home as a child—and I believed her—I still do!

"Now, this all sounds irrelevant to what I have to tell you, but it is all part of it, for had I not believed in the fairies, I would never have gone 'through' as I did. Even as a young man I was still interested in fairies and many a surreptitious hour I stole in the Children's Libraries reading about them—for though the stories have been written by three dimensional beings, they sometimes have caught the truth about the Little People, and I don't doubt but that some of them had a first hand acquaintance with the Fairy Folk, preposterous as that sounds.

"Sir Conan Doyle's alleged photographs of fairies are the real thing! You yourself have just seen creatures identical to the pictured fairies he has been so ridiculed for, but whereas his photographs are true replicas of the Folk, they came to him through accident, while mine have come after years of study and science.

"You may recall the summer I went to Ireland on a walking tour all by myself? I think it was when I was a sophomore, and I recall how everyone joshed me

when I returned the next fall and had to admit that I had spent my summer hiking through Ireland. But the trip was of more import than I let be known, for I had gone there purposely to learn more about the fairies and to see them if it was possible.

"For some reason the Irish seem closer to the Wee Folk than other peoples. People like to attribute that to their child-like minds, their love of make-believe. But I thought differently and reasoned that they knew more of them because there were fairies in that country whereas other countries had more or less been neglected by the tiny winged people. In England and Scotland you will hear talk of them among the country-folk, but not as you hear it in Ireland.

"So to Ireland I traveled.

"I left the cities behind and plunged into the country away from the beaten paths and into a rural section that had not changed since the days of Blind Rafferty.* It took a while for me to insinuate myself into the regard of the old folk, but I set about to make myself as likable as I could. Also I knew a few words of Irish Gaelic learned from that old nurse of mine. So I began to make friends and always I managed to lead the conversation around to the Wee People. I knew that the Irish are somewhat frightened to speak of them, for they will still talk of changelings and the little brownies who come and turn the milk sour overnight. And I heard a great many tales of that description. Also tales of folk who had been given wishes by the fairies in reward for some good deed performed in their behalf, or of the old woman who had been starving and awoke one morning to find the cat she had fed, despite her adversities, playing with a piece of silver, and that thereafter every morning she found another piece of money under the cat's paw.

"Only I was not content to listen to these tales. I wished to find the fairies—so it was that I learned that not many miles away in a wild part of the country was what the good people called the Fairy Ring! That was a ring in the grass that was unmistakable and which it was told was danced upon by the fairies at night! But woe unto him who ever fell asleep in that circle, for then he would surely awaken and come back with strange tales to tell and would lose his mind in the bargain. For the wee folk did not like for mortals to sleep in that circle!

"You may be sure that the next morning I was off toward that ring at dawn. I had to ask a number of countrymen I met on the way, for the direction, and was stared at askance for my daring. Three, of those I met up with, denied that they knew of such a place, but I thought all were lying. Then I met the crone. She was more like a witch, with her toothless gums and her thin straggling hair falling over her pointed face. She eyed me peculiarly for a moment.

" 'Ay, lad, you're a brave un,' she averred. 'But don't ye pay eny 'tention to what the wiseacres be telling ye. And shure they be such a ring, and ef ye sleep within its circle ye'll have pretty dreams to remember all yer life. And the Wee Folk'll be mannerly-like. Only don't ye be taking enything from 'em, not the weest flower, for they'll resent that. You see, me good lad, Oi've been there—oi've seen 'em. Worra, worra—but for me stiff joints oi'd be goin' back meself, and be content to end me days wid 'em.'

"THAT was all very heartening, so I gave her a piece of silver and was given explicit directions. And two hours later I was crawling through the copse which the old one had described in about the wildest piece of country I had seen as yet. Giant gnarled old trees groaned and moaned in the wind, and the grass underfoot was long and gone to seed. And there was the ring as plain as day, a brown ring on the sward as though the grass had been worn away by dancing feet! Only it was not a perfect circle as I had been led to believe, but an uneven, ragged line, circular, though roughly drawn. Surely fairies would not have danced that way. With beating heart I approached it, examined it, and tried to collect my thoughts, for with its finding had come a dazed sort of mind. It was all too good to be true.

"Then as I was tired from the long walk and the sun beating down upon my head had made me drowsy, I dropped to the grass. I recalled then that if one went to sleep, the fairies would come. So without hesitation I made sure that all of me was within the circle which was large enough to accommodate three or more. Before I went to sleep, though, I noticed something that appeared strange, but I was too sleepy to fathom, and that was the strange beautiful light that seemed ethereal. It hung all about me, a color that was mauve, old-rose and orchid. But in a twinkling of an eye I was asleep.

"I have no way of telling how long I slumbered there, but I was awakened suddenly by strange shrill little voices and was puzzled at first to find myself not abed. However, it did not take long for me to recollect everything. I looked about and I saw the fairies!

"There were about a half a dozen little creatures, hardly different than those you saw in the camera, Jack. Two were elves, little greenish fellows with pointed noses, little transparent wings like those the flies have, and two pointed antennas coming out of their eyebrows. Another was a gnome, a little hunchbacked creature with round beady eyes and a neat suit of brown cloth. The other three were fairies scarcely different than the conventional type you see in story-books, with dainty, beautifully formed bodies and big butterfly wings. They were sitting about either on the grass or upon the leaves of a bush close by. The gnome squatted on the projecting root of the plant. Not three feet away sat a brown rabbit with ears cocked surveying us all. The fairy people were taking me all in and appeared to have been waiting patiently for some time for me to awake. One of the elves stretched his tiny arms and yawned. Then I noticed the light about us, the same lovely coloring I had seen when I dropped off to sleep.

"I guess I would have sat there indefinitely if one of the fairies had not spoken. She was a lovely little thing of pink and cream with a mass of golden hair and the bluest of blue eyes. I have yet to see a prettier fairy.

" 'Good day to you,' she said and she had spoken to me in Gaelic! *'La Maith agad,'* she said, giving it the sweetest known pronunciation. *'Law maw agath.'*

"I returned her greeting, but I was a little disappointed for I knew that I could not carry on a very long conversation in that tongue and there was much I wished to learn. She must have read my thoughts, for the next time she spoke it was in English!

" 'Why,' she asked me, 'do all you people fall asleep before you come "through?" '

"I stared at her. 'I suppose,' I said, 'it is because we are

* There is a charming novel with this title by Don Byrne. Blind Rafferty is understood to have been a real personage, an Irish fiddler.

told that is the way we enter Fairyland! But I must admit that in my own case I was too tired from my walk here to do otherwise.'

"'It's been a long time since one of your kind have come "through at all," she observed.

"'Oh,' said I for something better to say, 'you do not have many visitors, then?'

"'Well, the truth of it is, that we do not encourage them to come. They like it so well here that they would all wish to stay—and then where would we be? They would overrun everything and put factories everywhere and make a pretty mess of it all. No, we discourage it, you see, and they believe the tales we tell about putting a madness on them. As though we could do that!"

"TO be sure that speech startled me. 'I see,' said I, 'but aren't you afraid I might do the same thing, now that you've told me that you can't put a madness on me?'

"She smiled broadly at that. 'You're different. They are but simple folk and you are a man with understanding. It would do not good for us to try tricks on you, for you would see through it all. Besides, did you not come from your distant country to find us?'

"I nodded, surprised at her discernment. It was as though she had read my mind.

"'I am reading your mind,' said she in answer to my thought, 'and I learn by it that you are a man who has always had love for us and a belief in us. You are welcome for as long as you wish to stay in our country. You may ask what questions you have in mind, although it is just as well that I tell you everything right now before we go any further!'

"'In the first place you will perhaps be much surprised to know that this country—or rather this world of ours is much the same as your own, that we have the same continents, the same oceans and rivers, et cetera, for in truth this is the same as the world you know, except in its aspect. It occupies exactly the same place as does your world, lies on top of it in fact, and only the Veil separates it. Look about you and see if you recognize anything familiar in the landscape?'

"Half understanding what she had been saying, I looked about. I could have sworn I was looking at the same country through which I had come. The topography was the same. Standing up I could see the same hillock I had come over, and the indentation where had lain the path by which I had come. To my left lay the low sweep of what had been bog land. Only now I could see nothing of the road and what had been bog was a pretty grass land, and the country about was different. Before it had been a wild ragged stretch, rough and unkempt. Now it was glade-like and appeared to have been turned into a parkland. Also there was a profusion of flowers that had been noticeable because of their absence this morning. I turned now to my interlocutor for an explanation.

"'It is the same country, you see, but you see it from the "other side" of the Veil. We cannot understand it ourselves or explain it scientifically as to where this difference lies, or what the Veil is composed of, nor anything about it. Perhaps you will be able to explain that for us, for you have great learning.

"'Nevertheless, whatever the explanation is, the fact remains that our country does occupy the same space as does yours. You build your cities, your houses and your factories, farm your land, turn your swamps into dry land and cut down your mountains, but nothing you do causes change in our world. We can sit exactly in the spot where you erect a palace and yet to us it is nothing but an open glade!

"'In the Veil are about a half a dozen openings, however, such as the one you have come "through" and by its means we are often able to go into your country just as you come into ours. Then there are places where the Veil is thin but not worn through. Through them we can see what goes on in your world or hear what you are about. It is because we do come "through" that your folk have learned about us and have seen us so that your literature is filled with tales about us, and you have pictures of us. However most of your stories about us are untrue, just as sometimes your artists caricature us. But of late years we have not gone "through" very often, for we quickly tire of your manner of living. You seem so futile with your wars, your everlasting digging and hoeing, your terrible noises and machinery and your entertainments. One must live with Nature to enjoy life, to eat the fruits that her bounty gives us, to live in the sun, to listen to the songs of the wind and to watch nature's drama. Why do you clutter up your world with ugly buildings and belch smoke into the God-given air, rush madly from one part of your world to the other without rest; kill the poor animals just for the pleasure of it and—oh, I could go on forever about your manners, but what's the use? You could not change it if you wanted to, for you are born of them and would not be happy differently, I suppose.'

"I stood there listening to the tirade of the little being, enthralled by her voice and her words, and wondering if she wasn't right. She scarcely paused for breath but went on speaking.

"'Perhaps all that is because you evolved from your ape-thing, a creature whom many ages ago we saw grubbing as you grub, planting, hoeing and reaping as you plant, hoe and reap, though you have improved on his methods. You kill animals for meat as he killed them, only you no longer need to stalk them in the jungles, but raise them on the plains and murder them scientifically! You build boats as he built boats to venture out upon the waters, for you have inherited your inquiring mind from him and you are not satisfied yet. And you have merely become more "civilized." You even climb into the skies now, and you do many tremendous things. But what does it bring you at all, but the desire to do more? You can't eat more than your first man did—but you can eat it better. You can't wear any more clothing than he did—oh, pardon me—you do, of course, but you are more uncomfortable for it—though your women are getting a little sensible in these days. You can't think of but one thing at a time—you can't do more than one thing at a time—yet you fill your brain and your world with strange thoughts and then try to prove them! I wish I could understand where you expect to get with it all!'

"I WANTED to say things in answer, but she gave me no chance, as though she knew all that came into my mind even as she herself spoke.

"'Now on the other hand,' she went on, 'we of our world evolved, not from ape-things, but from the little flying creatures. My forebears were butterflies! The elves are come from the bees, while the gnomes, little

industrious people, are of the ant-folk! There are still butterflies, bees and ants in our world just as there are apes and monkeys in your world, but somehow our ancestors managed to change that for us, though they did not change our love for flowers, for the sun, for everything that is clean and wholesome!'

"She paused at last and smiled. 'I see now that your mind is working over the problem of all this. You are beginning to see the light of something we have never been able to discover. Come, we shall go to headquarters and you can tell them of your opinions, if you will be so kind, although that will scarcely be necessary, since we are able to see all that goes on in your—three dimensional brain—ah that's the word for it isn't it?'

"I was astounded that she had read my thoughts so clearly, for I had been thinking that in truth I was in the Fourth Dimension! Scientists have for many years been trying to discover something of what they are wont to term dimensional science, although there are many other names for it, too. They claim that Nature did not come to a halt when she created the first three dimensions of length, height and breadth, but has gone on into the fourth, fifth, sixth and so on endlessly. Many would have it that the fourth dimension is one thing, and some another, that it is Time, that it is Space or Place. And here it had been for all time waiting to be discovered. The Irish had discovered it, to be sure, but they did not understand what it is all about, so that doesn't count. The fact remains that the fourth dimension is simply that of place, or the fact that two things occupy the same space at the same time! And here was a world that was occupying the same place as our own world, separated simply by what its people called the Veil.

"Now I was following my guide over the smooth grass of what appeared to be a great garden with the flowers allowed to grow wherever a seed had taken root. I was very careful to pick my way over these flowers, for what I had already learned taught me that the little people did not appreciate having their flowers crushed. The three little fairies were flying ahead of me gayly, just about the height of my eyes. The two elves came up behind and the gnome did not come along at all, but stayed sitting upon his root, and I had to admit that he did not much resemble his ancestor, the ant.

"After flying ahead of me for a minute or so, my pretty fairy changed her mind and came and perched herself upon my shoulder. I was left to understand that her companions would lead the way.

"'Once,' the fairy went on in that funny little way she had of running on as if she could never completely close her lips, 'one of the folk of the outside unwittingly stepped "through" the hole. He had a gun, and I think you'd call him a poacher. He did not appear to realize that he was in a different world than his own, and in a half a dozen minutes he had killed half a dozen rabbits, for our rabbits are not used to being killed and they do not run. And he walked on the flowers without a thought of them.

"'You may be sure we were angered, for usually when they come "through" they have fear in their hearts for us, and we like to keep them that way. Well, grabbing up stones we chased him back to the hole, and believe me he was frightened when he recognized us for what we were. As he went "through" he stumbled and fell on his head, so that he went to sleep for a while. So we rushed upon him and emptied his sack of the rabbits and found that three were not quite dead. These we nursed back to health. The others we had to bury. Then we thought of a way to frighten him forever so that he would not come back or tell his people of what he had found. Well, we did all we could to disfigure him so he would always remember, and then we put a hornet's nest upon his head, so that when he awakened again he was a sight to behold. And how they hurt him! After that he never returned and he noised the story about so that less people than ever came seeking the Fairy Ring.

"'Oh, which reminds me. You see, that ring is not worn by the dancing of our feet, if you must know the truth, but merely a "burn" from the edge of the "hole." You must have noticed the beautiful light at the opening as you came "through?"'

"I NODDED and looking about saw that now the air was as clear as any summer day.

"'That strange color,' went on my informant, 'is caused by the "tear" of the Veil and always marks any such "hole" or place where the Veil has become thin. And the edge of it burns the grass beneath. Perhaps you can explain that, too?'

"But I was not able to explain that until this week.

"Now we were nearing the first edifice I had seen in this Fairyland. It seemed to have been built of white stone, alabaster, no doubt. It rose about six feet and was about thirty in length, and was a beautiful thing of carving and jewels. Lovely flowers of stately mien clustered all about the foot of the walls. A pathway of stones set in the sod led to the graceful arched doorway which was about three feet in height.

"'We are not in the habit of building houses,' said the Fairy, 'but occasionally we do it to impress the Lesser Things, the gnomes and brownies and elves and such, for they need impressing upon. We usually live in the open entirely, just as nature intended us to. Only when a visiting dignitary comes do we use these buildings. You are fortunate that you need go no farther in search of Headquarters. Oh, yes, we fly to the tropics as the birds do in the cold seasons.' The last was in answer to the query that had come into my mind.

"'What sort of dignitaries do you have? Queens and the like!'

"'Oh, yes, Queens and Princesses. However, our rulers act merely as arbitrators in questions that arise among us. At present a gnome is being tried for having murdered a rat! It was a matter of jealousy, I believe.'

"'Is such a murder considered a bad crime?'

"'Why not? Why should anyone take a life that doesn't belong to him? It was not until your countrymen taught us the meaning of murder, that anything like this ever happened. But that is the way of you—to have commandments forbidding the doing of this and that, and it makes your people misbehave. It puts the thought into the mind!'

"'How is it that you know so much about our world and our history? One would think what you have lived there always yourself.' I demanded.

"'It is that you interest us, even as you are interested in us now. And then we have come into your world very often. But, the reason I know so much about your world is—because as I talk to you, I see it all pass through your brain, you see! Perhaps it is because I

am a Fourth Dimensional creature that I can see into your Third Dimensional brain, since I can occupy the same place as you do without your being the wiser!'

"I was struck by her clear reasoning, and I was to find all the people of Fairyland with such clear thinking brains. Nothing seemed impossible for them to comprehend. It was only a pity that I was not able to see into their brain-cases as they saw into mine, for I might have learned a great deal.

"For a month I stayed with them, living as they did out in the sun, eating fruits and sucking honey from flowers, only it was difficult for me to do the latter without killing the flower itself. They were sorry to see me go, and before I left they told me that in my own city back home I would find one of the 'holes' through the Veil by which I could enter their world whenever I pleased. It luckily was in a garden, they said. I believe they even knew it was here in this garden, but they are mischievous people and wanted me to go in search of it myself!

"I have been 'through' here in the garden and these fairies across the sea were as nice as those in Ireland, though as I have said before, I haven't seen one that is half as pretty as Neila, my little guide. I've had a few of them here in the house and grounds, but they are very shy and will not allow themselves to be seen by a stranger. However, they will always come about when I wish to photograph them, for they like to have their pictures taken!"

So Keller ended his story and poured some brandy for himself.

Warren did not speak immediately, but his eyes were troubled.

"You do not believe me, Jack?" queried Keller.

"It sounds like a very good Fairy Story, Charlie. The best I have ever heard."

"But, Jack, you have seen the fairies yourself? Come we will develop the picture that you yourself snapped!"

"How is it that you take those pictures? You did not tell me that."

"It has taken me all these years to do that. During my visit 'through the Veil' I began to realize that that Veil was nothing more than a certain 'ray' from the sun, which formed the barrier, that the molecules of our atmosphere took up and created, hiding what lay over that boundary from our three dimensional eyes. I began to study the various known rays, the X-ray, the Violet-Ray, the Infra Red-Rays and down through the line. And only last week I discovered the Z or Mauve-Ray that forms that curtain. My camera simply enables me to photograph what lies beyond. I think that in time I shall be able to take a photograph directly through the Veil without the need of seeking the 'Hole'."

Warren had nothing very much to say and in an hour or so he was back at his hotel. In his possession he had the "photo" he had snapped himself, but he never showed it to anyone. In later years he was to show it to his wife and a few select friends, and tell something about what Keller had told him. They would listen politely and say that they had heard of Charles Keller, who had tried to follow in the footsteps of Sir Conan Doyle, and remark that his strange disappearance was one of the mysteries of New York. Warren secretly believed that Keller was still alive—not in the world of Three Dimensions, but in that strange Fairyland they had both peered into. The old Keller house is no more, and the garden is covered over by a skyscraper, but Warren believes that the "Hole" exists there still.

THE END

The Noise Killer

By A. M. McNeill

(*Continued from page* 153)

were frightened and left the city . . . all those who weren't killed."

"And you . . . what makes you stay in such a gruesome place?" I asked, crawling out from under the wing.

"I don't know. What makes any of us cling to lost hopes. I never quite gave up hope of being able to remember what my brother said. Some day, perhaps when I am dying, it will come to me what he said and then I'll be able to lift the curse from this beautiful city so that people can live in it again. Can I help you, young fellah? I have the keys to these buildings and anything in them is yours."

Before night actually closed in I had made repairs and was on my belated way again. As I tilted my wings and droned up into the air, it occurred to me that the only name by which I could identify the place was a half-obliterated "ville" I had seen on the shed. In this lack of definite data lies the second reason why I could not include the strange visit in my official report and why I am writing it now for the first time. Clearly, it was the only course for me to follow.

THE END

Madness of the Dust

By R. F. Starzl

(*Continued from page* 159)

A girl detached herself from the group. She rushed to the side of the stretcher. She gave Steve a quick hug and a kiss, and then she was inside the ship. She had to climb a dirty metal ladder and thread her way through a maze of pipes and tanks before she finally found Farrington. He was gazing sadly out of a port at a waving sea of tropical trees.

"Jack!" she said.

"Oh, hello, Alfreda!"

"Aren't you glad to see me?"

"Oh, sure; you bet!"

"I've something to tell you, Jack."

"I know it already," he said gently. "I hope you and Steve are very happy."

"We're all happy," she said, uncomprehending, "and so relieved! When your radio went dead we didn't know what happened. We could only guess, and worry." She was laughing in glad release from the tension.

"I guess I had to mess up something," he explained. "I had a relapse of that dust thing and was half crazy. I tore that transmitter to bits, after I'd finished and got Steve to bed. I can't just remember what happened. It was a nightmare!"

"Poor, dear Jack!" she murmured softly. "Aren't you going to kiss me?"

"Why, why—I thought——"

"No more Martian trips for you!" she chattered gaily. "The Board of Directors has voted to appoint you manager of the planetary port at Gibraltar. I'll love it there, and Jack, I'm so glad to think that our children will not have to be born and raised on foreign soil. I'm old-fashioned that way. I'd never feel really at home except on the good old Earth."

THE END

A Circe of Science

By Stanton A. Coblentz

(*Continued from page* 173)

species, were found lying dead in every street and field.

Evidently the creative energy breathed into them by Gilcrest had indeed been exhausted! Evidently they had completed their racial term of life! And they were to pass out like a fire which expires all the more quickly for having been vivid and vehement.

Such, in fact, proved to be the case. A few lingering specimens of Gilcrest's creations survived throughout the winter, and even into the spring of 1966; and then the world, waiting fearfully, incredulously, half expecting the peril to be renewed, found that it was greeted only by the ordinary plants and animals. And once more the wheels of factories began to rumble, and the edge of farm implements to seek the soil. The Reign of Confusion was over; and mankind, racked with suffering and less numerous by several millions, turned toward a future in which scientific experimentation was to be conducted much more cautiously than it ever had been carried out in the past. Man had learned his lesson from sad experience.

THE END

In this department we shall discuss, every month, topics of interest to readers. The editors invite correspondence on all subjects directly or indirectly related to the stories appearing in this magazine. In case a special personal answer is required, a nominal fee of 25c to cover time and postage is required.

AN INTERESTING COMMUNICATION FROM DR. MILES J. BREUER ABOUT GIGANTISM IN ANIMALS, AND THE EXISTENCE OF NORMALLY HUGE ANIMALS

Editor, AMAZING STORIES:

Some time ago you published my story, "The Hungry Guinea Pig." Here are some comments on it, or in connection with it, that may be of value or interest to you.

From time to time one sees the criticism that a giant animal is an absurdity; that it is impossible for such a giant animal to exist, because its own weight would crush it; that it could never move from the spot, and so forth.

The best answer to these criticisms is that the stories of giant animals, within reasonable limits, are supported by actual facts. We know, as definitely as any scientific fact is known, that animals up to one hundred feet in length, existed and moved about actively, right on this same old world, when gravitational attraction was quite the same thing that it is at present.

With modern knowledge of nutrition, internal secretions, and biochemistry, the story of the thirty-foot cockroach or the worm that swallowed a mill are far more reasonable than the idea of a gravity screen. There is a direct chain of scientific reasoning to support the large animal body, and a fair prospect of its ultimate realization in the laboratory. Whereas the gravity screen is *a priori* an impossibility, largely because we are convinced, by the new views of the universe, that there is no such thing as the force of gravity. If gravity is not a force, how can it be screened? Gravity is a relationship of motion and position; how can an abstraction like that be screened? It seems to me that Einstein has put the old type of space-traveler out of business; he will have to give up the gravity screen and find a new method.

The objections to the giant laboratory animal are based on the conceptions that the weight of an animal increases as the cube of a linear dimension, whereas its muscular strength increases only as the square. (That is not my statement; that is what the critics say.) And on the interesting natural fact that an ant is able to carry 200 times his own weight, whereas a man carries barely more than his own weight while an elephant cannot carry his own weight.

It is true that there is a limit to the size that animals can assume on this earth. But this limit cannot be found on the basis of the above cube-and square relationship. Here is the way to find it:

The strength of a muscle increases with the cross-section of the muscle. (Its length determines only the amplitude of its contraction.) The weight of muscle depends on its volume, therefore both

(*Continued on page* 183)

The Pea Vine Mystery

"Things all are shadows, shadows all,
And ghosts within an idiot's brain—
A little while, they fade and fall,
A little while, they come again."

—SELECTED

THERE lay the body. The man was known to have been subject to fits which would seize him and render him unconscious for sometimes two days at a time—but these were usual with him and he had been given many more years to live by the doctors. It was practically certain he had not died of one of these seizures. Then what had killed him?

He was found where he had fallen, into a mass of tangled roots of the common pea, in a hole which had been recently dug. It was with some difficulty that they disentangled the vines, particularly from around his neck. Strangulation? Possibly, but these seizures were never known to cause the man to struggle when an attack came on—he simply dropped, unconscious.

As there was no mark on him, and no stones near for his head to hit, the cause had to be either the fit, or strangulation by cutting off his air supply.

The county farm agent commenced to study the mystery and finally came out with a most astonishing theory—he claimed that at that time of year pea vines grew very rapidly. He also claimed that not only did they grow rapidly, but that their strength was prodigious—that as they grew they could lift a 300-pound weight for every square inch exposed. He claimed that the heat of the man's body, along with a recent shower, and combined with the trophism of the roots to seek the ground again, caused them to crisscross over the man's throat, swell and strangle him while he was unconscious. This theory was finally accepted.

By A. L. HODGES.

The Dead Sailor

THE sailor was undoubtedly dead and there was a mark on his head as if he had been shot. But they could find no bullet, and besides, the men who witnessed the accident heard no shot, nor saw anyone else around. There was no doubt about the testimony; too many men verified it.

The sailor had been lowering an experimental half shell from the side of the ship when the rope broke and the shell dropped into the sea. Some of the witnesses claimed they saw a bright object come up from the sea and hit the sailor. But no bright object was found.

The device which was being lowered was a half sphere, open at the bottom, and with a short length of small pipe fixed in its top. This pipe was open at both ends.

One of the scientists on board resolved to clear up the mystery. He had an idea and decided to follow it out, but to do some computations before he told anyone—for he was a serious scientist and did not want to be laughed at, for practical men are given to ridicule.

He finally came to the conclusion that the sailor was shot and killed with a bullet of water. After many expressions of doubt on the part of the rest of the party he proved conclusively to them that it was not only possible but that that was just what had happened. He proved it in this wise: the entire weight of the heavy shell was used when it hit to compress the air caught under it. The air of course would start leaking out of the small pipe, or shooting out, very rapidly. When the end of the small pipe was submerged, however, which operation took place almost instantly, the compressed air shot a plug of water up to the sailor's head with the force of a bullet—and slew him. The scientist fortified his remarks with citations from accidents from water-hammer, etc., that clinched belief.

"We know neither the day nor the time."

By A. L. HODGES.

READERS' VOTE OF PREFERENCE

Stories I like:

1.
2
3
4

Why

Stories I do not like:

1.
2.
3.
4.

Why

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on cross-section and length

What would be the conditions in a horse twice as big as an ordinary horse? A horse ten feet high and sixteen feet long?

His weight, increasing as the cube of a linear dimension, would be eight times that of a normal horse. Therefore, he would need eight times the muscular power for his original activity. To give him eight times as much power, the average cross-section of his muscles would have to be eight times as much as normal.

An increase in length of the muscle would not help; it is the cross-section that would be required.

A horse twice as big as normal would already have twice the normal cross section, therefore twice the power. Our big horse would need *relatively*, four times more power than his increased size would give him. That is, to give him four times more muscle cross-section than he already had, his muscles would all have to be of twice the *relative* diameter that they are on a normal horse.

This double *relative* muscle diameter would hardly be noticeable as we looked at the horse, it would be evident as an increased plumpness. As I can remember, the greatest difference in diameters of biceps muscles I have personally seen would make the largest three times the diameter of the smallest.

Therefore, the larger the animal, the greater its *relative* muscle volume. As the muscle weight is about one-third the body weight, an animal could increase possibly to ten diameters before breaking down of its own weight; though when of this size, it would be tremendously, bulgingly full of muscles. This is what we see in Nature. The muscles of an ant are relatively so small, and thin that we cannot see them. But look at the picture of a dinosaur. The great masses of muscle on him are quite necessary to move such a great animal.

The above discussion, of course, leaves one question untouched. That is the intrinsic contractile strength of muscle fibers. That is something we know nothing about, except in vague generalities. Do two muscle fibers of exactly the same diameter contract with equal power? They do not. Just as two automobiles of the same size may differ markedly in power, muscle fibers from various animals vary enormously.

For a big animal to be very lively without increase in muscle volume, merely some alteration in intrinsic contractile power might be sufficient. Our present knowledge of biology indicates nothing so emphatically as that there are vast deeps of knowledge that we have not as yet penetrated.

Miles J. Breuer, M.D.
Lincoln, Nebr.

(This letter from Dr. Breuer is so authoritative that it needs no comment from us. How the gigantic animals of geologic eras managed to crawl about or perhaps even to walk or run with their enormous bodies may rank as a real problem. But the fossil remains tell us that such animals did exist and that they were quadrupeds.—Editor.)

AN INTERESTING LETTER ON INTERPLANETARY TRAVEL FROM ONE OF OUR AUTHORS

Editor, AMAZING STORIES:

In the comments made on my letter which appeared in the March issue, I see I did not make my reason for eliminating the rocket type of interplanetary ship clear. I eliminated it from our discussion because it has inherent practical defects that limit its use in a discussion on acceleration.

A rocket gets its power and speed by ejecting burning gases. The weight of unused fuel must then be carried when we leave Earth, and it must be lifted against Earth's gravity as we leave the planet. The more slowly we burn that fuel, the longer it lasts, and the further we go while the fuel is still being carried. Hence, the more work we do in lifting fuel. If we burn the fuel very quickly, get rid of a great portion of it before we have lifted it very far, we do less work on lifting fuel. Thus, the more rapidly the rocket discharges its fuel, the more efficient it is. A rocket necessitates a high acceleration, and we were discussing the effects of acceleration on the men alone, so I suggested that we consider any other type, a type which will permit of as low a rate of acceleration as we wish without impaired efficiency.

Then, as I have said, an acceleration of four times gravity would not be dangerous, and would probably be quite endurable. The rather peculiar idea of using a floatation method of easing the strain, in a bathtub as I put it, takes advantage of the fact that the man will always float in the water, no matter how great the acceleration, if he will float under normal gravity, for, though the man grows apparently heavier with increasing acceleration, the apparent weight of the water

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increases in proportion. Thus the man weighing perhaps three-quarters of a ton, might float readily! The water would relieve the weight of arms and legs and head, and prevent the tendency to flatten out. Of course it would be no aid to the important internal organs, the weight of the heart and lungs, and brains would be the real limiting factors.

With this acceleration of four or five gravities the ship can make Mars in as few as six and a half days, which is plenty fast enough!

The effects of high pressure in a caisson on the workers are not truly comparable to the effects of acceleration in an interplanetary ship. The effects felt by men working under increased air pressure are due primarily to two factors, the great amount of nitrogen which dissolves in the blood, and the increased oxygen concentration.

Nitrogen dissolves in the blood under pressure, and when the man comes out from the pressure, like the bubbles in soda water, the nitrogen forms bubbles, the effect being very painful—giving the worker that disease known as the "bends."

But the most serious effect is due to the fact that the man tends to "burn up" under the greater oxygen concentration. It is well known that men die in an excess of pure oxygen. Any animal will die in an atmosphere of pure oxygen. The atmosphere of pure oxygen furnishes an oxygen pressure of fifteen pounds per square inch on the lung surface. In normal air about 20 per cent of the pressure is supplied by oxygen, or about 3 pounds per square inch. The animal that dies in pure oxygen at atmospheric pressure lives comfortably in pure oxygen under three pounds per square inch. It is well known that aviators at high altitudes cannot live even with pure oxygen; they have not enough oxygen concentration, the oxygen pressure is too low; the result is attained at lower altitudes, when plain air is used. The pressure of the oxygen is always one-fifth the air pressure, but when pure oxygen is used, one-fifth the pressure needed with air is sufficient to support the man. If the pressure is increased on the other hand, the oxygen concentration is increased with it, until, when the pressure reaches that due to a depth of 175 feet of water, the men might as well be breathing pure oxygen at normal pressure. It is this effect of increased oxidation rate, faster living, that produces some of the dangerous effects in the caisson. In an interplanetary machine the damage is done by mechanical pressure on the organs, a thing we can in no way approach on earth, save by using a centrifugal force seat, for instance, and thus produce the effect of heavy accelerations. It would flatten one's heart against the walls of the chest. This is the effect most to be dreaded, *plus* the mechanical pressure on the brain. There is no known way to lessen these, so, as a matter of fact, the bathtub would be of little real assistance, though it would at least be more restful, and relieve the fatiguing strain of the pressure.

I wish to make a reply to the comment of Mr. E. G. Guding also. His comment on measuring in thimblefuls shows he has a true appreciation of the "size" of the erg—one dyne centimeter—the work done in lifting a pin head through the distance of one centimeter, but he has misdirected his criticism. It is not I who developed this unit, but the scientists. The figure I used, 900 000,000, 000,000,000,000 ergs was derived by direct substitution of the figures in the general formula, $E = MC^2$, where E is the energy in the units of the system of measurement employed, M the mass, and C the velocity of light in those same units. If we use the English system, E will be in foot-pounds, M in slugs (the unit of mass in the English system, a unit mass being that mass which, acted on by a force of one pound, will have produced in it an acceleration of one foot per second per second, this unit being then, 32.2 pounds) and C must be in feet per second. This will give us approximately 1,000,000,000,000,000,000 foot pounds of work—which is hardly measuring in thimblefuls! But the units I used in the original are the units any scientist would use: the C.G.S.—centimeter-gram-second units. Remember too, that a scientist would actually measure the solar system in centimeters, for they are the actual units of the C.G.S. system, the system almost universally used.

Similarly, in any calculation in the English system, we should measure the system in feet, not miles.

These numbers being so large, the usual exponential system is used, the speed of light being 3×10^{10} and is in centimeters per second, while the energy per gram in matter is given as 9×10^{20} ergs.

John W. Campbell, Jr.,
38 Bigelow St.,
Cambridge, Mass

(One point about interplanetary travel seems to

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be overlooked by those who write about it. As soon as an airship would get away from the earth far enough to practically eliminate gravity and be in a vacuum, it would need very little fuel. So for the first many thousand miles of its travels, rather millions of miles, it would use very little fuel, as, traveling in a vacuum, it would have no head resistance, and would not have to be supported against gravity. Then after reaching a certain point it would be attracted by the gravity of the planet to which it is traveling and here its use for fuel would be not to drive it ahead, but to prevent it from going too fast. So when anybody goes on a trip to Mars or any other interesting planet, we do not feel that they need worry much about the fuel question. We feel, however, that Mr. Campbell has pretty well laid down the laws for a trip to Mars.—Editor.)

A HARD-WORKING CRITIC. THE GRAPH OF AMAZING STORIES

Editor, AMAZING STORIES:

As I have indexed AMAZING STORIES since the first volume was completed, it recently came into my head that it might be interesting to graph each volume, issue by issue, in accordance with the system by which I grade stories in the Index—three stars for exceptional stories, two stars for very good ones, one star for stories worth reading but rarely worth rereading. Only eight stories have fallen below one star in four years, while four issues including the February issue have been perfect, containing 100 per cent three starred stories. All these have been in Volume 4. Since I felt that one or two poor stories might drag down an otherwise excellent issue, I inaugurated a "Bonus" system of averaging, whereby issues containing a majority of three-star stories gained one point above the numerical mean, a majority of two star stories, gained ½ point, and a 'perfect' issue gained two points. In the rare cases when the issue came just below the majority for either bonus, I have judged by the tone of the entire issue, whether or not to grant the extra credit. Such an issue is the June issue of this year, and also the July issue, in which the extra value was in each case added, the actual average making half of the stories triple-starred.

Looking back at the first years of the Index, it seems that I was then almost unduly critical, as there are several stories to which I would at present give higher rating. However, as they represent my judgment at the time, and as I fully remember any story worth rating, I have not altered the grading. As the graphs stand, they represent, aside from actual progress, an expanding tolerance and judgment from a Sophomore in High School to a Junior in Union College, and from the ages of 14 to 18—an important period. I believe that the graphs are most valuable unchanged. When I have time, I hope to plot another set of graphs, showing the influence of each issue upon the cumulative average, and showing the percentages of three- and two-starred stories. If you are interested, I will be glad to send them when finished.

The graphs for both Monthly and Quarterly, show that after the novelty of the first year fell off, the quality of the issues began to slump (possibly paralleling a slump in sales?) However, the average did not fall far, and in the third year a rise took place, especially noticeable in the Bonus graph, leading to another sag toward the end of the year. Suddenly, during the winter and spring of 1929, the level shot up, reaching its first peak of "Perfection" in May, 1929, then dropping, but not far, and again shooting up to its present summit—three "Perfect" issues in five months—with the volume-averages the highest in history. You will probably find parallel occurrences, of which I can know nothing, in your circulation and other data. What is most interesting is the rapid climb to excellency—so consistent a climb that I fear—and hope—that I will soon have to remodel my grading system or slide along at an even "three" of perfection. One of the great advances, of which I have not taken account, except subconsciously, is the improvement in artists, especially in the acquisition of Briggs. Paul was good, in his way excellent, but he had marked weakness, and the change since he left is remarkable. We will have to frame our covers soon. Vary the cover artist too, if you can, and let him choose the story which he considers best from the point of view of potential illustration. In the past, the distant past, the selection of cover material has been frankly rotten.

As to long serials, I agree fully with their previous advocates. It takes an exceptional author to write a *Good* long serial, or a *Good* very short story—especially the former. Burroughs has done it once in "The Land that Time Forgot." Merritt has never failed yet to my knowledge. There must be others. While a number of under-length stories

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give more scope and variety, they do not permit the fullest development of an important theme, and, if while good they lead to sequels, there is almost always a drop in quality. I have agreed so far with your choice of sequels, and in all but a few cases I have been disappointed with the result. I almost felt that it would be best to have an entirely different author write the sequel or sequels, as Jules Verne did so wonderfully for Wyss's "The Swiss Family Robinson." Again this is a personal opinion, as the above is a personal rating and graphing, but I wonder if I am the only one who feels that way about it.

While it is not wise to neglect the excellent modern fiction and let it go to the bettering of at present inferior competitors, I think that at least one long classic—by Wells, Verne, Cummings, A. Merritt, H. Rider Haggard, Clement Fezandié, Garrett P. Serviss, or one of the other authors, most recommended by readers—should be printed each year, with several shorter ones—only the best. I know that many readers oppose this view, but I wonder what direct vote would show—and which is better literarily.

In accordance with your present and near future policy, what lengths will you consider in fiction by unestablished authors? This question has a personal background, for in my college course in chemistry, I frequently run across phenomena and concepts that I feel would make good fiction. I get a great kick out of writing them up and developing them, as well as a good bit of knowledge, for I usually have to put a good deal of study of fact into the development. Most of them I have scrapped, as too near something that has been written before, but I have a few that are new and all run to length—the wrong length, it seems to me. My longest and most hopeful, would take up twelve or thirteen pages, maybe more, as its length is about 16,000 words, but I have hopes for shorter ones, one on the Arrhenius theory of life spores that will be finished soon. There is no magazine in which I would rather see them, and I may get up courage to send one in, though each time I read them they seem worse from the literary viewpoint. Aside from my own interest, a statement as to generally encouraged lengths might help out some other discouraged author who wants to bud and doesn't dare. I may not succeed as an author, even if I do as a chemist, but I'll go on writing, as a way to develop a concept, just as long as I am struck by new phenomena and new possibilities—and I'll keep on getting a kick out of it, and a lot of knowledge from reading Plato and Rubenius, studying infinite series, topography, or primitive mythology, or working out perspectives and planetary motions for a background to what may develop of its own accord into an actual theory or merely a story. There seems to me to be a great field unopened in taking folk lore seriously and building on its strongest points, as Mr. Verrill did in "The Bridge of Light." Then there is mathematics, probably the most beautiful of the sciences, as well as the most fundamental and independent. We limit our mathematical fiction to the fourth dimension—Good, excellent, but not enough. Here, "John Jones' Dollar," by Henry Stephen Keler, April, 1927, and "Futility," by Capt. S. P. Meek, July, 1929, are exceptions. Last, but not least, we steer clear of the extremes, the upper limit of "The People of the Pit," "The Face in the Abyss," "The Moon Pool," "The Thing from—Outside," and "The Color Out of Space," of A. Merritt, H. P. Lovecraft, and Allan England—where lies the greatest work and the greatest good in scientifiction, the enlarging of the concept, the mental grasping at something attainable but just out of reach of the pictorial and sensual imagination, concepts which one must grasp at with man's greatest and least used weapon—the power of pure thought and imagination. I cannot gulp down and understand totally the silent ones, the People, the Face, the meaning and powers of the thing or color, but I can almost do it, and in time I may. Great mathematicians can see mentally the fourth dimension of mathematics as through a lifting haze. So it is with the great works of scientifiction, even Burroughs' scheme of Evolution in "The Land that Time Forgot," and as my mind develops through study, the haze is lifting with each rereading. I hope that there will be more beyond the rising fringes when I am able to see that far. After all, there is not so much difference between these frontiers of scientifiction and the concepts of pure religion and pure philosophy, is there? All deal with ultimates, with great enveloping fundamental forces, that it takes an eternity to grasp—with the wonderful possibilities of the Cosmos—and scientifiction is bringing it the closest of the three. Too much would be paralyzing to the mind, but can we not have more of these near heresies of possibility, and less of the hidebound? You are slowly reach-

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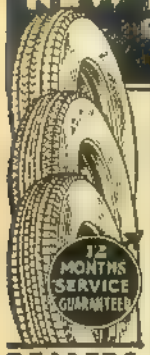

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ing those heights through the acquisition of better authors, but those few summits of the past, which I have mentioned, still overtop anything in the four perfect issues or any other issue. Force me to adopt a new system of grading and indexing where these shall be above the three-star level, the level which is becoming the average rather than the peak. Make me use a whole galaxy of stars to mark the gems that you offer. There must be more such stories somewhere. Publish them, for they are greater than half a year of the rest. Which again is a personal view, but not solely so, I hope, for if so, I must be mildly insane to think in this way.

Finally, a question. Is it still possible to obtain from your offices a copy of the first Quarterly, featuring H. G. Wells' "The Sleeper Awakes?" My own copy has fallen victim to the inevitable borrowers, together with two years of other magazines, and I hope that I can at least duplicate it. If you have, and I can afford it, save it and notify me for it breaks an otherwise perfect collection.

P. Schuyler Miller,
302 S. Ten Broeck St.,
Scotia, New York.

(This long letter which indicates a great deal of study, needs no additional comment. The questions you ask in regard to our manuscript requirements will be answered through our office.—EDITOR.)

INTERPLANETARY STORIES AND ASTRONOMY. THE ROCKET PROPULSION IN COSMIC SPACE

Editor, AMAZING STORIES:

I have been reading AMAZING STORIES for a little over a year now, and although I have unintentionally skipped an issue now and then, which I much hated to do, I will say that I am very much "taken up" with your magazine, which I always read from cover to cover. As I am, and always have been, much interested in science, and also am quite a reader, I find much interesting and valuable material in the various stories published in your publication.

I like interplanetary stories the best of all and think you have printed some mighty fine ones. Of the various methods that might be employed for motive power in traveling to other planets, I believe that the rocket type of ship, with its action and reaction principle, will be the first to be used in time; although it probably will originally be used as a means for transcontinental travel here on earth. Although such a device would have more recoil in the earth's atmosphere by having the air to react against, it stands to reason that the friction of the air would just about counteract this added impetus. Another reason I favor the rocket type of travel is because of the fact that the rocket tubes can be arranged for steering the ship in any direction while out in space. This should not be overlooked as one might easily become lost or get off his course while flying through space, if he didn't have a means with which to guide his ship where he wished. Some authors, while dealing with interplanetary travel, simply give their space-fliers the power for traveling, head the vessel for some far distant planet, and trust to luck to reach their destination. "The Explorers of Callisto" in the February issue brings out this point very clearly.

Why doesn't some author write a story about the sun? I think the sun should make a good theme for a story, as the whole universe depends upon it for its existence. Personally, I believe the sun is undergoing a change known as the annihilation of atoms, thus releasing atomic energy in the form of the light rays. It stands to reason that the sun could not be merely a big fire because it would burn itself out in short order on account of its very intensity.

I would like to know if any scientist has ever found out just what light, gravity and magnetism are and what causes light and electricity to have such tremendous speeds. I have theories of my own along these lines but will say that I believe that light, life, and electricity are closely related; that electricity and matter are the same, and that gravity and magnetism are the same. With the exception of matter, perhaps the reason for the others not being more readily understood is because they have no mass or anything tangible to work upon.

L. M. Howell,
1924 Factory Street,
Owasso, Mich.

(Perhaps the reason that so many of our readers like yourself enjoy interplanetary stories more than others is, because some of our best writers are devoted to this class of narration. Sometimes there is an astonishing lot of good astronomy in an interplanetary story. We have in mind one author, who, by his scientific attainments, is particularly well adapted for this class of narration and who

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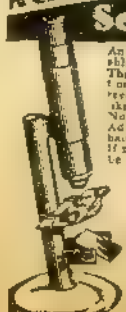

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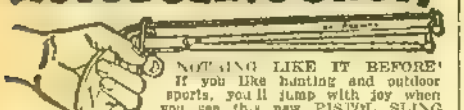

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is devoting considerable of his work to it. Like many others, you fall into the error of believing that a rocket acts by pushing against the air While the stream of gas has to displace air, this displacement does not help the rocket; rather it hinders it. It would go much faster in a vacuum. The old Newtonian theory that action and reaction are equal and opposite applies to rockets. You could push against an object with a bar or solid object, but how could you push against anything with a stream of gas which has absolutely no solidity? If one did get into interplanetary space with some kind of a motor ship, it is hard to imagine any method of driving it through the vacuum other than the rocket principle. The propellers of an airplane would be absolutely futile there, but rocket propulsion would operate very well. The reason that power has to be expended in driving an airplane is twofold. It has to overcome the action of gravitation and the resistance of the air. These are so tied up together that it is the stream of air flowing over the surface of the wings which supports the plane. But if you got up into interplanetary space and were so far removed from celestial bodies that gravitation would be almost negligible, there would be nothing to stop you from going ahead and hardly any power would be required to keep you aloft, as the sailors say. So once your rocket got you up one hundred miles or so, a rocket not much bigger than a firecracker would almost have a visible effect on the propulsion. No one knows what light, gravity and magnetism are. There is a current belief that man will never find out the cause of gravity. It seems to be or rather is, so deep a mystery.—Editor.)

THE GREEN PRISM OF MANABITE CONSIDERED

Editor, AMAZING STORIES:

My sincere apologies to Mr. A. Hyatt Verrill, the author of "Beyond the Green Prism," if my following statements are misconstrued by my oversight of the facts in reading his wonderful story on the vast microscopic unknown.

Why does not the green prism alter the size of other ingredients than animal substances? Would this not open a field to greater possibilities in the story if the altering of size of all substances were to be in the same proportion?

If as stated in the story, the green prism does not alter the mineral and plant substances as well as the animal, then to my conception the appearance of Romano's friend before Romano's wife would be rather an embarrassing incident, as the buttons of his clothes would undoubtedly be left behind on the larger earth by the camp; also the nails of his shoes would desert him as well as the gold and silver filling of the teeth in his head

And possibly the non-animal substances which he had probably eaten beforehand, such as beans which he ate, as they are rather an appropriate camping food.

Outside of this, according to my interpretation, this story is a remarkable conception of microscopic study. And the fact that the author dwells upon the possibility of another substance than glass for microscopic lenses might lead, as the author states, to a revolution of microbe study. If I were a scientist I would do some research upon this

This is my first written description of a supposed fallacy in AMAZING STORIES although I have been an ardent reader of this true-to-the-title book for the past two years.

I might state for the future well being of your magazine that you add to the hall of fame of your advanced literary articles, a story based upon a friendly and benevolent visit from some of our more highly intellectual sister planets. This, I believe, would please some of your readers, and indeed I would be delighted. Something along the lines of a missionary invasion of old Mother Earth to enlighten our present day burdens, such as, health, crime, prohibition, war, and politics. Possibly the high tariff and "Farmer" questions which are troubling our senators and many others today.

I don't pretend to be a literary genius, but I believe I shall attempt to write upon such a subject as I have stated. I hope you will receive it gladly

I might question you if you receive unsolicited fiction for your wonderful magazine.

Thomas H. Glass,
1900 6th Avenue,
Altoona, Pa

(We read all fiction that is sent to us, solicited or otherwise. We are anxious to find new authors and we certainly have done our part in bringing many to the fore. In Mr. Verrill's stories you must look for slight inconsistencies. The "Green Prism" stories, of which there are two, have been very highly appreciated by our readers. Mr. Verrill has a world-wide reputation as an ethnologist and explorer.—EDITOR.)

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A FLAME IN A VACUUM

Editor, AMAZING STORIES:

There was a bad error on the cover of your [illegible] issue. You show a jet of flame reaching [illegible] consume a man, who is exploring the moon, which, according to the story, has no atmosphere, that is, there is a vacuum surrounding the moon.

Now, even a layman, such as I am, knows that a fire will not burn without oxygen. Therefore, I think the cover of your magazine is wrong.

Martin Yanke,
2463 W. McMicken Ave.,
Cincinnati, Ohio.

(Could not the necessary oxygen be supplied by the blowpipe through the opening of the jet? The oxyhydrogen blowpipe is used by divers many feet under the surface of the water in operating on wrecked vessels and other iron or steel which is submerged. It cuts through iron or steel just as it does in air although fifty or more feet below the surface. The oxygen is all supplied by the blowpipe and its connections. So here is a flame under water.—EDITOR.)

A NICE EXPOSITION OF METAPHYSICS

Editor, AMAZING STORIES:

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Reprinting the works of Poe, Wells and Verne, thus giving your magazine a distinctive literary flavor, and, at the same time, disseminating a more general knowledge to the public of the three great originators of Scientifiction.

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I read Mr. Myer's letter on the 4th dimension in your February issue with interest. That he is correct in so far as Mr. Olsen's stories are concerned is apparent.

Before closing, may I remark that it is an odd fact that neither the stories nor the letters have attacked the problem of the 4th dimension from the familiar standpoint of subjectivity. In this respect Ouspensky's views are rather interesting. In an attempt to prove the Kantian dogma of the subjectivity of Space and Time he agrees with H. G. Wells that they are identical and that Time is the 4th dimension of Space imperfectly sensed. Applying this hypothesis to the world about us he suggests that a snail, for example, possessing only *sensation*, exists in a one-dimensional world, or *senses* the world as existing on an infinite line. An animal, say a dog, possessing sensation and *perception* and seeing only surfaces, construes the world as two dimensional, or as existing on an infinite plane. A man, having sensation, perception and *conception* also sees nothing but surfaces, but he *conceives* the third dimension, and the 4th dimension of Space he hazily construes as Time. Thus, if we admit the theory of evolution as an ever present factor in existence, it follows that man may arrive at a mental state as high above conception as conception is above mere perception, and as Space is subjective, he would to all intents and purposes be a four dimensional being

But enough of metaphysics. If you ever decide to publish a bi monthly, count me in.

J. P. O'Gorman,
Hazelton Station,
Youngstown, Ohio.

(This letter hardly needs a comment. It is extremely clever. We hope, in the future, to republish some of the leading stories which we have given, but that is all in the future. Your exposition of the why and wherefore of the four dimensions is interesting and you bring out the point that the fourth dimension is rather hazy after all.—EDITOR.)

A CORRESPONDENT WHO SHOULD READ THE DISCUSSIONS COLUMN

Editor, AMAZING STORIES:

I have been reading AMAZING STORIES for the last two years and I enjoy them very much.

I do not read the Discussions Columns very often, but I have noticed lately a tendency to criticize the printing of the stories by Jules Verne and H. G. Wells. "The Time Machine" by H. G. Wells, and "The English at the North Pole" with its sequel "Deserts of Ice" were three of the most enjoyable stories I have ever read and I only hope you will print more like them.

Your synopsis of each story in the Editor's comment at the beginning is very good as it gives one an idea whether it would suit one's taste.

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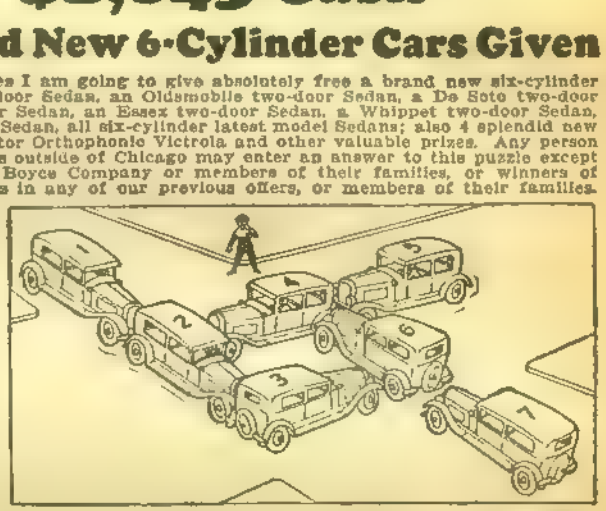

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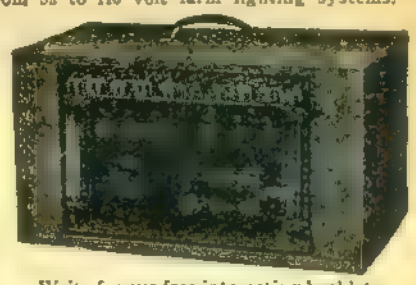

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All readers cannot be suited, so why criticize any *one particular* story. Mr. Bishop criticizes "The Superperfect Bride" in the January Discussions Column. I thought this story especially good; on the other hand I did not care for "The White Army" because I read for pleasure and not for education, yet others enjoyed it a great deal.

The one general fault I have to find with Scientifiction Stories are the disastrous endings. The human race prefer happy endings to their stories and I imagine that is the reason that Scientifiction Stories are not more generally popular.

Merrill L. Stewart,
6945 Clinton Road,
Stonehurst Hills, Penna.

(We have two classes of writers whose products we give in our column. The one class are the authors of our stories and we think very highly of them and find that our readers appreciate them very highly. The other class of authors are those who write us the interesting and often valuable letters which we publish in the Discussions Column. Many of our readers turn to these columns before they read the rest of the magazine. We say all this because we observe that you tell us that you do not read the Discussions Columns very often. Your views that it is useless to criticize one particular story, is carried out over and over again, when some correspondent dislikes stories, which have met with the highest approval from others. You will find many letters of this character in the Discussions Column. EDITOR.)

A. S. IS A FICTION MAGAZINE—NOT A PHYSICS BOOK

Editor, AMAZING STORIES

I have often wanted to write you my opinion of AMAZING STORIES. In my estimation, the magazine is O.K.

I have heard a lot about changing the cover and shortening the stories. Suit yourself about the cover; but *don't* shorten the stories.

A. S. is a fiction magazine—not a physics book, as some of the fans whose letters I have read seem to think it should be. Keep it a fiction magazine.

The first AMAZING STORIES Magazine I read was the QUARTERLY, the first story, "The Moon of Doom," by Earle L. Bell. It was a good story, but there is something I would like to know about it. When Prof. Mildred and Ernest were prisoners in the cave, why didn't the professor put a lot of coal in the bowl? As inanimate objects can not reason, He—She couldn't have been able to distinguish between coal and a human being. I cannot understand why the professor committed suicide.

I finished the January A. S. MONTHLY and I think "When the Atoms Failed," by J. W. Campbell was the best story, with "The Fourth Dimensional Space Penetrator," by J. Kendig, Jr., a close second.

About Mr Kendig's story, I understand the Space Penetrator was capable of traveling through the air. Why, then, did not the Doctor simply rise above the flames and heat of burning Lenonia, and carry Lama to Palmite? Please enlighten me on this subject.

As for the booklet idea, I say, "Bring it on!" Here's for more and better AMAZING STORIES.

B. Willbank,
510 N. 3rd Street,
West Monroe, La.

(When you say that our magazine is not a physics book but is a fiction magazine you certainly hit the nail on the head. The stories have got to have romance in them, have got to have fiction in them. We, too, are very much interested in Mr. Campbell's work. He has a very extended knowledge of physics and certainly has the knack of putting his knowledge into very acceptable form, as is evidenced by our Discussions Columns. Perhaps Mr. Bell will tell you why he killed off the professor in the "Moon of Doom."—Editor.)

"THE GOSTAK AND THE DOSHES" AGAIN EXCITES COMMENT

Editor, AMAZING STORIES:

The story "The Gostak and the Doshes" in the March issue of your magazine was extraordinary! I have never had the pleasure of reading a fiction story of such compelling interest and reasoning. Give us more like it. (P. S.—I had a headache for two hours after trying to reason it out.)

I thought the story "The Ship That Turned Aside" very good also.

I liked all of the stories in this issue and I trust you will continue with such a high quality of reading matter.

George Buckman,
Hillside and College Avenue,
South Nyack, N. Y

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(Dr. Breuer's curious satire, as you may call it, has received a great deal of complimentary criticism. We certainly hope to continue to maintain the status of AMAZING STORIES as a distinctively high class magazine.—Editor.)

AN AMUSING LETTER ABOUT THE GOSTAK AND THE DOSHES

Editor, AMAZING STORIES:

Have just read your March number. The chief flaw in Dr. Breuer's story is that he is not precise enough. You may tell him that these are my sentiments: only the gostak distims the doshes; the only gostak distims the doshes; the gostak only distims the doshes; the gostak distims only the dosbes; the gostak distims the only doshes; the gostak distims the doshes only! Is this clear enough? I hope it is; for, in this case, I shall not be arrested as a traitor in the x-y-z world.

And I am most anxious to go to this world. Ask Dr. Breuer what the best system is. I have already made a start; for I have looked at one of those crinkly curtains till the outside crinks seemed to stick inward and the inside crinks outward. It was necessary, however, to close one eye in order to do this. And I suppose this is ineffectual; for, if it were the proper method, then "Dead-eye Dick," or any other single-lamped fellow, would already *be* there!—But tell me the right way. And be sure to include a process by which the gostak and the doshes may likewise be turned inside out; so that I may be prepared to die cheerfully in order that the gostak may succeed in its distimming operations.

Felix B. Wadel,
Tyler, Texas.

(Again we have Dr. Breuer coming to the front, but this time as the subject of a correspondent's letter with one of his very clever stories as the topic. Perhaps "Dead-Eye Dick" *is* there. There is much in this story that can be read between the lines.—Editor.)

WHAT IS WRONG WITH OUR MAGAZINE

Editor, AMAZING STORIES:

I have been reading your magazine for about two years, and never have I made any criticism of any sort. However, the time has come when I feel that, as an old reader, it is my duty to tell you what is wrong with your magazine.

Having noticed the growth and development of your magazine in the past two years, I want to say that it is not satisfactory. Why don't you try publishing your magazine twice a month, and omitting all drawn out serials? There is another serious mistake you have been making just recently and that is the including of romance in your stories. A female has absolutely no place in stories of a scientific type such as yours are.

And, why can't you have a correspondence page for letter-hungry persons, who would like to hear from someone in another part of the world? Now, I don't know whether this letter will ever reach your hands or not, but unless something is done about this matter of Scientifically Romantic Stories, I'm going to stop reading your magazine. If you can't stop them absolutely then you can at least cut them down.

Referring back to the correspondence topic, I want to say that I have seen it successfully established in other magazines, and I guarantee you that the amount of publications of your magazine will increase voluminously.

Robert Dalton,
537 East 53rd Street,
Brooklyn, N. Y.

P.S.—Perhaps I was a bit hasty about quitting you, but that's the way I feel.

(You object to romance in our stories. Romance is definitely a phase of human interest, and there is a feeling amongst some of our associates that there might be more human interest than there is in our stories. As the publication stands now, there is comparatively little romance in our pages. We do not understand what you refer to by "a correspondence page for letter-hungry persons." The Discussions Columns certainly seems to us to answer this description. You also will observe that we make a point of publishing the full addresses of our correspondents so that they can be written to by others. We feel that correspondence columns for this magazine, which with few exceptions are devoted to publishing the complete text of each letter, are a most valuable feature. By not cutting out parts of letters, we have been forced in many places to publish unfavorable criticisms, but it does everybody good to be constructively criticized. As regards your postcript, we are glad you think you were a bit hasty.—Editor.)

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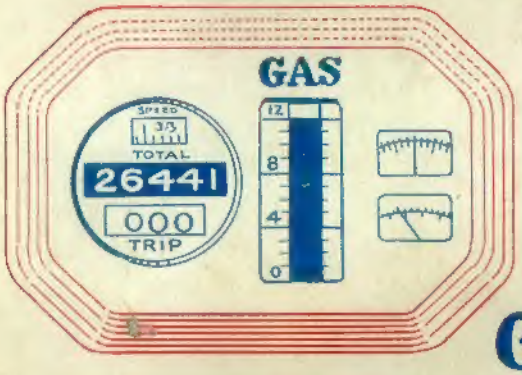

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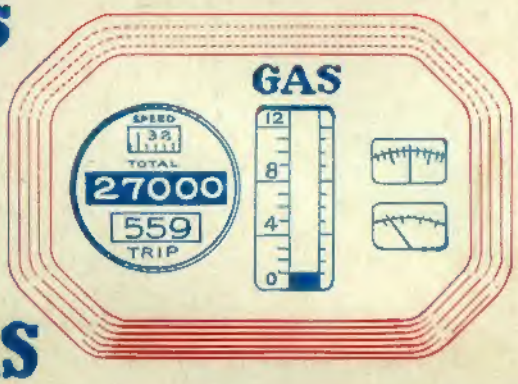

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P. P. Goerzen writes: "I made an actual test both with and without a Whirlwind, getting 13½ miles without and 34 6/10 miles with the Whirlwind, or a gain of 21 miles to the gallon. The longer the Whirlwind is in use on the machine, the better the engine runs, has more pep and quicker starting. It makes a new engine out of an old one, and starts at the touch of the starter button."

R. J. Tulp: "The Whirlwind increased the mileage on our Ford truck from 12 to 26 miles to gallon and 25% in speed. We placed another on a Willy's Knight, and increased from 12 to 17 miles per gallon.

Arthur Grant: "I have an Oakland touring car that has been giving me 15 miles to the gallon average, but I can see a great difference with the Whirlwind, as it climbs the big hills on high and gives me better than 23 miles to the gallon of gas, which is better than 50% saving in gas."

W. A. Scott: "I had my Whirlwind for three years. Winter and summer it gives the same perfect service, instant starting, smoother running, and what I saved in gasoline these last few years has brought other luxuries which I could not have afforded previously."

Car owners all over the world are saving money every day with the Whirlwind, besides having better operating motors. Think what this means on your own car. Figure up your savings—enough for a radio—a bank account—added pleasures. Why let the Oil Companies profit by your waste. Find out about this amazing little device that will pay for itself every few weeks in gas saving alone.

FITS ALL CARS

In just a few minutes the Whirlwind can be installed on any make of car, truck, or tractor. It's actually less work than changing your oil, or putting water in the battery. No drilling, tapping or changes of any kind necessary. It is guaranteed to work perfectly on any make of car, truck or tractor, large or small, new model or old model. The more you drive the more you will save.

SALESMEN AND DISTRIBUTORS WANTED

Free Sample and $100.00 a Week Offer

Whirlwind men are making big profits supplying this fast-selling device that car owners cannot afford to be without. Good territory is still open. Free sample offer and full particulars sent on request. Just check the coupon.

WHIRLWIND MANUFACTURING CO.

999-230-A Third Street Milwaukee, Wisc.

GUARANTEE

No matter what kind of a car you have—no matter how big a gas eater it is—the Whirlwind will save you money. We absolutely guarantee that the Whirlwind will more than save its cost in gasoline alone within thirty days, or the trial will cost you nothing. We invite you to test it at our risk and expense. You are to be the sole judge.

FREE TRIAL COUPON

WHIRLWIND MANUFACTURING CO.
999-230-A Third Street, Milwaukee, Wisc.

Gentlemen: You may send me full particulars of your Whirlwind Carbureting device and free trial offer. This does not obligate me in any way whatever.

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County ..... State .....

☐ Check here if you are interested in full or part time salesmen position.